

DEPARTMENT OF COMMERCE.

BUREAU OF STANDARDS.

GEORGE K. BURGESS, Director.

1924 (JANUARY) SUPPLEMENT TO CIRCULAR NO. 24: PUBLICATIONS OF THE BUREAU OF STANDARDS.

This supplement is issued from time to time to keep current and to supplement the information given in Circular of the Bureau of Standards, No. 24: Publications of the Bureau of Standards. This supplement will bring up to date the information listed below under "Contents."

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1. DESIGNATIONS OF PUBLICATION SERIES.

Six series are issued: Scientific Papers, Technologic Papers, Circulars, Handbooks, Simplified Practice Recommendations, and Miscellaneous Publications. The separate papers in each series are consecutively numbered. An initial letter preceding each number shows the particular series: S for Scientific Papers, T for Technologic Papers, C for Circulars, H for Handbooks, M for Miscellaneous Publications, R for Simplified Practice Recommendations—thus T203 is "Technologic Papers, No. 203." In referring to publications the series *initial* and the *number* are both needed to give complete identification.

2. PUBLICATIONS NOT AVAILABLE.

The publications listed below are not available for distribution by the Bureau of Standards nor for sale by the Superintendent of Documents. They may be consulted at some of the designated Government depository libraries listed on page 4.

Scientific Papers.—S1, S2, S3, S4, S12, S13, S16, S19, S22, S24, S25, S27, S29, S33, S34, S35, S36, S37, S38, S39, S41, S42, S43, S44, S45, S46, S49, S50, S51, S52, S55, S58, S59, S60, S61, S62, S68, S72, S77, S79, S81, S84, S89, S90, S93, S94, S95, S96, S100, S102, S103, S104, S105, S108, S112, S113, S114, S115, S118, S121, S122, S123, S125, S128, S129, S130, S133, S138, S139, S140, S142, S143, S146, S147, S149, S151, S155, S157, S162, S165, S166, S168, S173, S174, S182, S187, S189, S190, S202, S203, S212, S213, S214, S215, S216, S226, S228, S232, S233, S241, S243, S255, S258, S261, S269, S275, S279, S285, S291, S381, S422.

Technologic Papers.—T₂, T₃, T₅, T₁₄, T₁₇, T₁₉, T₂₃, T₂₆, T₂₇, T₂₈, T₃₀, T₃₁, T₃₂, T₃₅, T₃₇, T₃₉, T₄₄, T₄₅, T₄₆, T₄₈, T₅₁, T₅₄, T₅₇, T₆₅, T₆₈, T₇₁, T₇₃, T₇₄, T₇₈, T₈₂, T₁₀₀, T₁₀₈, T₁₁₈, T₁₂₂, T₁₃₇.

Circulars.—C₁, C₂, C₄, C₈, C₁₂, C₁₄, C₁₅, C₂₁, C₂₂, C₂₃, C₂₈, C₂₉, C₃₄, C₃₉, C₄₅, C₅₀, C₅₄.

Miscellaneous Publications.—M₁, M₄, M₅, M₈, M₁₁, M₁₃, M₁₇, M₁₈, M₂₀, M₂₂, M₂₅, M₂₉, M₃₀, M₃₁, M₃₃, M₃₄, M₃₅, M₃₆, M₃₈, M₅₀.

3. DISTRIBUTION.

A small edition is available for official distribution to libraries, technical journals, and experts who cooperate in the work or who are directly concerned with it. Others may purchase the publications at the nominal price shown. The large number of requests for Bureau of Standard publications precludes sending personally dictated replies in each case. Each request, however, is given careful attention and a typed form letter reply is prepared, stating fully the action taken on each item of the request or other information needed.

4. BOUND VOLUMES.

The separate Scientific Papers (the original term "Reprints" is not now used) are consecutively paged to about 750 pages, which make up a complete volume. Title-page and index are then printed and the completed volume is bound.

5. PRICE LIST FOR BOUND VOLUMES.

	Per volume.
(a) Bulletins of the Bureau of Standards, vols. 1-14, inclusive; 1904-1914 (cloth).....	\$2.00
(b) Series (a) continued—Scientific Papers of the Bureau of Standards, vols. 15-18 (cloth).....	2.00
(c) Unbound separates, preprints of (b), sent as issued.....	1.25
(d) Combination of (c) and (b).....	3.25
(e) Technologic Papers of the Bureau of Standards, vol. 16 (cloth).....	2.00
(f) Unbound separates of Technologic Papers sent as issued.....	1.25
(g) Combination of (f) and (e).....	3.25

Subscriptions for either series may be placed in advance with the Superintendent of Documents to receive the separates as issued at \$1.25 per volume (unbound), and \$2 for each volume bound in cloth.

Purchase orders with remittance should be sent addressed simply Superintendent of Documents, Government Printing Office, Washington, D. C. Do not send any such orders or remittances elsewhere. Order by serial initial letter and number combined (for example, T203). If initial and number are correctly given, the title is not needed. All publications are sent out by the Superintendent of Documents, as provided by law, and usually reach destination within a week or two.

6. LATEST DATA CONCERNING CURRENT EDITIONS OF CIRCULARS.

Cir. No.	Edition.	Date.	No. of pages.	Price.	Cir. No.	Edition.	Date.	No. of pages.	Price.
1.....	1	Dec. 1, 1903	3	.....	75.....	1	Jan. 10, 1918	127	15
2.....	5	Apr. 30, 1915	21	5	76.....	1	Apr. 21, 1919	120	20
3.....	3	Dec. 23, 1918	89	15	77.....	1	Mar. 10, 1919	67	10
4.....	2	Jan. 3, 1905	2	.....	78.....	2	Mar. 20, 1923	14	5
5.....	3	July 16, 1917	19	5	79.....	2	Jan. 19, 1923	53	15
6.....	7	Dec. 30, 1916	30	5	80.....	2	Sept. 2, 1922	34	20
7.....	5	Oct. 1, 1913	19	5	81.....	2	Dec. 21, 1922	32	10
8.....	3	Aug. 11, 1921	18	5	82.....	2	June 8, 1922	9	5
9.....	8	Mar. 31, 1916	32	10	83.....	1	Jan. 31, 1920	35	5
10.....	3	May 9, 1918	19	5	84.....	2	July 3, 1922	8	5
11.....	3	June 23, 1917	18	5	85.....	2	July 3, 1922	9	5
12.....	3	July 16, 1906	7	.....	86.....	2	Oct. 6, 1922	11	5
13.....	10	Feb. 7, 1923	17	5	87.....	2	Oct. 3, 1922	8	5
14.....	5	Mar. 20, 1916	17	10	88.....	2	July 3, 1922	8	5
15.....	3	July 1, 1911	7	5	89.....	2	July 3, 1922	10	5
16.....	5	July 13, 1922	16	5	90.....	2	May 23, 1922	8	5
17.....	3	Mar. 18, 1916	50	15	91.....	2	June 21, 1922	8	5
18.....	2	July 1, 1911	4	5	92.....	1	June 7, 1920	94	30
19.....	5	Mar. 30, 1916	67	15	93.....	2	June 21, 1922	9	5
20.....	2	May 28, 1915	57	15	94.....	2	July 7, 1922	8	5
21.....	1	Mar. 1, 1910	30	5	95.....	1	June 28, 1920	24	5
22.....	2	May 15, 1911	12	.....	96.....	1	June 15, 1920	5	5
23.....	1	July 15, 1910	93	15	97.....	3	July 3, 1922	10	5
24.....	6	July 1, 1922	182	.....	98.....	2	Feb. 29, 1923	10	5
25.....	8	June 26, 1923	14	5	99.....	1	Nov. 12, 1920	44	10
26.....	4	Apr. 5, 1921	20	5	100.....	1	Mar. 21, 1921	106	20
27.....	2	Aug. 9, 1918	41	10	101.....	1	Feb. 9, 1921	52	10
28.....	1	Mar. 1, 1911	19	.....	102.....	2	Sept. 22, 1922	5	5
29.....	1	Dec. 31, 1910	13	.....	103.....	3	July 22, 1922	6	5
30.....	2	July 6, 1920	25	5	104.....	2	Jan. 31, 1923	7	5
31.....	3	Oct. 1, 1914	76	20	105.....	2	Sept. 18, 1922	4	5
32.....	4	Dec. 7, 1920	140	20	106.....	1	Nov. 24, 1920	15	5
33.....	3	Jan. 18, 1917	43	10	107.....	1	Feb. 12, 1921	37	10
34.....	3	May 15, 1915	16	5	108.....	1	Jan. 3, 1921	21	5
35.....	4	Dec. 1, 1919	2	5	109.....	1	Jan. 3, 1921	9	5
36.....	1	June 30, 1912	26	5	110.....	1	Feb. 26, 1921	8	5
37.....	2	Jan. 1, 1915	13	5	111.....	2	June 24, 1922	8	5
38.....	4	Sept. 28, 1921	127	20	112.....	1	June 24, 1922	214	65
39.....	1	Dec. 16, 1912	14	5	113.....	2	July 7, 1922	104	25
40.....	3	Sept. 10, 1920	13	5	114.....	1	July 30, 1921	10	5
41.....	3	Sept. 20, 1918	15	5	115.....	1	Oct. 27, 1921	18	5
42.....	2	Aug. 29, 1921	11	5	116.....	1	Aug. 17, 1921	5	5
43.....	2	Jan. 24, 1921	46	10	117.....	2	July 3, 1922	6	5
44.....	2	Jan. 30, 1918	196	25	118.....	1	Dec. 8, 1921	7	5
45.....	1	Nov. 1, 1913	89	10	119.....	1	Feb. 6, 1922	3	5
46.....	3	Dec. 26, 1922	22	10	120.....	1	Apr. 24, 1922	16	5
47.....	1	July 1, 1914	68	15	121.....	1	July 17, 1922	14	5
48.....	2	June 10, 1916	202	40	122.....	2	Sept. 12, 1923	16	5
49.....	2	May 4, 1915	50	10	123.....	1	July 27, 1922	5	5
50.....	2	June 8, 1917	34	5	124.....	1	July 27, 1922	4	5
51.....	1	Dec. 1, 1914	39	15	125.....	1	July 27, 1922	3	5
52.....	2	June 28, 1916	44	10	126.....	1	July 27, 1922	5	5
53.....	1	Mar. 29, 1915	35	10	127.....	1	July 27, 1922	4	5
54 ¹	2	Nov. 15, 1916	323	30	128.....	1	July 27, 1922	5	5
55.....	1	Aug. 28, 1915	149	15	129.....	1	July 27, 1922	4	5
56.....	2	Sept. 26, 1923	262	60 ²	130.....	1	July 27, 1922	5	5
57.....	2	May 11, 1916	64	15	131.....	1	July 27, 1922	5	5
58.....	2	June 22, 1923	68	10	132.....	1	July 27, 1922	4	5
59.....	1	Apr. 5, 1916	13	5	133.....	1	Nov. 10, 1922	21	10
60.....	2	Mar. 12, 1920	68	15	134.....	1	Sept. 16, 1922	4	5
61.....	2	Aug. 31, 1920	44	10	135.....	1	Oct. 16, 1922	14	5
62.....	3	Jan. 24, 1923	24	5	136.....	1	Sept. 22, 1922	4	5
63.....	1	May 17, 1917	8	5	137.....	1	Feb. 23, 1923	19	10
64.....	1	Apr. 20, 1917	6	5	138.....	1	Mar. 21, 1923	33	10
65.....	1	July 23, 1917	19	5	139.....	1	June 15, 1923	9	5
66.....	1	July 25, 1917	13	5	140.....	1	Mar. 26, 1923	6	5
67.....	1	Jan. 17, 1918	8	5	141.....	1	Mar. 24, 1923	18	10
68.....	1	Oct. 6, 1917	8	5	142.....	1	Apr. 16, 1923	48	15
69.....	1	Nov. 17, 1917	85	15	143.....	1	June 25, 1923	5	5
70.....	1	Dec. 5, 1917	259	25	144.....	1	July 6, 1923	7	5
71.....	1	Sept. 18, 1917	8	5	145.....	1			
72.....	1	June 17, 1918	84	20	146.....	1	Sept. 25, 1923	6	5
73.....	2	Nov. 14, 1922	113	20	147.....	1	Sept. 19, 1923	8	5
74.....	1	Mar. 23, 1918	330	60	148.....	1	Oct. 10, 1923	9	5

¹ Superseded by C₄₄.² Superseded by H₃ and H₄.

7. GOVERNMENT DEPOSITORY REFERENCE LIBRARIES.

Congress designates in the several congressional districts certain libraries as "Government depository libraries." These receive sets of Government publications on the understanding that they are kept available for consultation by the general public.

If a publication is requested which can not be obtained free from the bureau or by purchase from the Superintendent of Documents, the bureau refers the correspondent to the nearest depository reference library where the bureau's publications may be consulted.

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Ala.	Athens.	Athens College.	Del.	Dover.	Delaware State.
	Auburn.	Alabama Polytechnic Institute.		Newark.	Delaware College.
	Birmingham..	Howard College.		Newcastle.	Newcastle Library Co.
	Mobile.	Public.	D. C. ...	Wilmington.	Free.
	Montgomery..	Association Public.		Washington.	Agricultural Department.
		State Capitol.			Army War College.
Alaska		State and Supreme Court.	Fla.		Interior Department.
	Tuskegee Institute.	Carnegie.			Justice Department.
	University.	University of Alabama.			Navy Department.
	Fairbanks.	St. Matthews Free Public.			State Department.
Ariz.	Juneau.	Alaska Historical Society and Museum.	Ga.		Treasury Department.
	Phoenix.	Public.		Deland.	John B. Stetson University.
Ark.	Tucson.	University of Arizona.		Gainesville.	University of Florida.
	Conway.	Hendrix College.		Jacksonville.	Public.
Calif.	Fayetteville.	University of Arkansas.		Tallahassee.	Carnegie Library of the Florida State Normal and Industrial School.
	Jonesboro.	State Agricultural Schools.	Hawaii.	Winter Park.	Rollins College.
	Little Rock.	Arkansas State.		Athens.	University of Georgia.
	Magnolia.	State Agriculture Schools.		Atlanta.	Carnegie.
Calif.	Pine Bluff.	Branch Nor. College.		Augusta.	Georgia State.
	Alturas.	Public.	Idaho...	Dahlonega.	Georgia Agricultural College.
	Berkeley.	University of California.		Douglas.	Georgia Normal and Business Institute.
	Claremont.	Pomona College.		Oxford.	Emory College.
Calif.	Eureka.	Free Library.		Savannah.	Georgia Historical Society.
	Fresno.	Free.	Ill.		Georgia State Industrial College.
	Los Angeles.	Public.		Honolulu.	College of Hawaii.
	Sacramento.	California State.		Albion.	State Normal School.
Calif.	San Diego.	Free Public.		Boise.	Idaho State.
	San Francisco.	Public.	Ill.	Moscow.	University of Idaho.
	Santa Rosa.	Free Public.		Pocatello.	Idaho Technical Institute.
	Stanford University.	Leland Stanford Junior University.			Public.
Calif.	Stockton.	Free Public.		Bellefonte.	Public.
	Boulder.	University of Colorado.	Ill.	Bloomington.	Illinois Wesleyan University.
	Colorado Springs.	Colorado College Coburn.		Chicago.	John Crerar.
	Denver.	Colorado State.			Newberry.
Conn.		Public.			Public.
	Fort Collins.	Regis College.	Ill.	Danville.	St. Ignatius College.
	Pueblo.	University of Denver.		Evanston.	University of Chicago.
	Bridgeport.	Agricultural College.			Public.
	Hartford.	McClelland Public.		Freeport.	Northwestern University.
Conn.		Public.	Ill.	Galesburg.	Public.
	Middletown.	Connecticut State.		Jacksonville.	Free Public.
	New Haven.	Trinity College.		Joliet.	Public.
	Storrs.	Wesleyan University.		Lisle.	St. Procopius College.
Conn.	Waterbury.	Yale University.	Ill.	Monmouth.	Monmouth College.
		Agricultural College.		Normal.	Illinois State Normal University.
Conn.		Silas Bronson.		Olney.	Carnegie Public.
				Peoria.	Public.

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Ill.....	Rockford.....	Public.	Me.....	Saco.....	Dyer Library Association.
	Springfield.....	Illinois State Historical Society.		Waterville.....	Colby University.
		Illinois State.	Md.....	Annapolis.....	Maryland State.
Ind.....	Urbana.....	University of Illinois.			United States Naval Academy.
	Bloomington.....	Indiana University.		Baltimore.....	Enoch Pratt Free.
	Crawfordsville.....	Wabash College.			Johns Hopkins University.
	Evansville.....	Willard Library.			Peabody Institute.
	Fort Wayne.....	Public.		Chestertown.....	Washington College.
	Greencastle.....	De Pauw University.		Westminster.....	Western Maryland College.
	Hanover.....	Hanover College.			Amherst College.
	Huntington.....	City Free.	Mass.....	Amherst.....	Massachusetts Agricultural College.
	Indianapolis.....	Public.		Boston.....	Athenaeum.
	Jasper.....	Jasper College.			Public.
	La Fayette.....	Purdue University.			State Library of Massachusetts.
	Merom.....	Union Christian College.		Cambridge.....	Harvard College.
	Muncie.....	Public.		Lowell.....	City.
	Notre Dame.....	Lemonnier Library of University of Notre Dame.		Lynn.....	Public.
	Richmond.....	Morrison Reeves.		Marlboro.....	Public.
	Terre Haute.....	Indiana State Normal School.		New Bedford.....	Public.
Iowa.....	Ames.....	Iowa State College.		Salem.....	Essex Institute.
	Boone.....	Ericson Free Public.		Taunton.....	Public.
	Cedar Falls.....	Public.		Tufts College.....	Tufts College.
	Council Bluffs.....	Free Public.		Williamstown.....	Williams College.
	Des Moines.....	Public.		Worcester.....	American Antiquarian Society.
	Dubuque.....	Carnegie-Stout Free Public.			Free Public.
	East Des Moines.....	Iowa State.	Mich...	Ann Arbor.....	General Library of University of Michigan.
	Fairfield.....	Free Public.		Battle Creek.....	Public School.
	Fayette.....	Upper Iowa University.		Benton Harbor.....	Public.
	Grinnell.....	Iowa College.		Detroit.....	Detroit College.
	Iowa City.....	State University of Iowa.			Public.
	Mount Pleasant.....	Iowa Wesleyan University.		East Lansing.....	Michigan State Agricultural College.
	Mount Vernon.....	Cornell College.		Grand Rapids.....	Public.
	Sioux City.....	Public.		Houghton.....	Library of the Michigan School of Mines.
	Tabor.....	Tabor College.		Kalamazoo.....	Public.
Kans...	Baldwin.....	Baker University.		Lansing.....	Michigan State.
	Emporia.....	Kansas State Normal.		Muskegon.....	Hackley Public.
	Hlawatha.....	Morrill Free Public.		Orchard Lake.....	Polish Seminary.
	Lawrence.....	Spooner Library of University of Kansas.		Port Huron.....	Public.
	Manhattan.....	Kansas State Agricultural College.	Minn...	Saginaw.....	Hoyt Public.
	Pittsburg.....	Public.		Duluth.....	Free Public.
	Sterling.....	Cooper College.		Faribault.....	Public.
	Topeka.....	Kansas State.		Fergus Falls.....	High School.
		Kansas State Historical Society.		Minneapolis.....	Public.
	Wichita.....	Fairmount College.			University of Minnesota.
Ky.....	Danville.....	Centre College of Central University.		Stillwater.....	Public.
	Frankfort.....	Kentucky State.		St. Paul.....	Minnesota Historical Society.
	Glasgow.....	Public.			Minnesota State.
	Henderson.....	Public.		Winona.....	Public.
	Lexington.....	State University.	Miss...	Agricultural College.	State Normal School.
	Lincoln Ridge.....	Lincoln Institute of Kentucky.			Mississippi Agricultural and Mechanical College.
	Louisville.....	Free Public.		Brookhaven.....	Public.
	Paducah.....	High School.		Greenville.....	Public.
	Somerset.....	Carnegie Public.		Jackson.....	Carnegie Millsaps.
	Winchester.....	Kentucky Wesleyan College.			Mississippi State.
La.....	Baton Rouge.....	Hill Memorial Library of State University.		Oxford.....	Mississippi State University.
	Natchitoches.....	State Normal School.	Mo.....	Cape Girardeau.....	State Normal School.
	New Orleans.....	Howard Memorial.		Chillicothe.....	Hazleton Public School.
		Louisiana State.		Columbia.....	College of Agriculture and Mechanical Arts of Missouri State University.
		Louisiana State Museum.			University of Missouri.
		Public.		Fulton.....	Westminster College.
	Ruston.....	Tulane University.		Hannibal.....	Free Public.
		Louisiana Industrial Institute.		Jefferson City.....	Missouri State.
Me.....	Augusta.....	Maine State.		Kansas City.....	Public.
	Bangor.....	Public.			Rockhurst College.
	Brunswick.....	Bowdoin College.		Liberty.....	William Jewell College.
	Lewiston.....	Bates College.		Rolla.....	Missouri School of Mines.
	Orono.....	University of Maine.			
	Portland.....	Public.			

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Mo....	Springfield....	Drury College.	N. C....	Chapel Hill...	University of North Carolina.
	St. Joseph.....	Public.		Davidson.....	Union Library of Davidson College.
	St. Louis.....	Christian Brothers College.		Durham.....	Trinity College.
		Public.		Greensboro...	Colored Agricultural and Mechanical College.
	Warrensburg....	St. Louis University.		Newton.....	Catawba College.
Mont...	Bozeman.....	Washington University.		Raleigh.....	North Carolina State.
		State Normal School.		Wake Forest...	Wake Forest College.
	Butte.....	Montana Agricultural College.		Washington...	Public Schools.
		Montana State School of Mines.	N. Dak.	Agricultural College.	Agricultural College.
	Helena.....	Historical Department of Montana State.		Bismarck.....	North Dakota State.
		Public.		University.....	State Historical Society.
Nebr...	Missoula.....	University of Montana.		Valley City....	State University of North Dakota.
	Fremont.....	Public.			State Teachers' College.
	Grand Island..	Carnegie.	Ohio....	Alliance.....	Mount Union Scio College.
	Lincoln.....	Library of the University of Nebraska.		Athens.....	Carnegie
		Nebraska State.		Bucyrus.....	Public.
	Omaha.....	Public.		Chillicothe....	Public.
Nev....	Carson City...	Nevada State.		Cincinnati....	Public.
	Reno.....	University of Nevada.		Cleveland.....	Adelbert College.
N. H....	Concord.....	New Hampshire State.			Case.
	Dover.....	Public.		Columbus.....	Public.
	Durham.....	Hamilton Smith Public.			Ohio State.
	Hanover.....	Dartmouth College.		Dayton.....	Ohio State University.
	Laconia.....	Public.			Public.
N. J....	Manchester....	City.		Delaware.....	Public Library and Museum.
	Atlantic City...	Free Public.			Charles Slocum Library of Ohio Wesleyan University.
	Bayonne.....	Free Public.		Gambier.....	Kenyon College.
	Camden.....	Free Public.		Granville.....	Denison University.
	Elizabeth.....	Public Library and Reading Room.		Hiram.....	Hiram College.
		Free Public.		Lebanon.....	Public.
	Jersey City....	Free Public.		Marietta.....	Marietta College.
	Newark.....	Free Public.		Oberlin.....	Oberlin College.
	New Brunswick.	Free Public.		Oxford.....	Miami University.
	Paterson.....	Rutgers College.		Portsmouth...	Free Public.
	Princeton.....	Free Public.		Sidney.....	Public.
	Trenton.....	Princeton University.		Springfield...	Warder Public.
N. Mex.		Free Public.		Steubenville...	Carnegie.
	Albuquerque...	New Jersey State.		Toledo.....	Public.
		University of New Mexico.		Van Wert.....	Brumback Library of Van Wert County.
	East Las Vegas	Normal University.	Okla...	Ada.....	East Central State Normal School.
	Santa Fe.....	Territorial.		Altus.....	Public.
	State College..	General Library of New Mexico College of Agricultural and Mechanical Arts.		Alva.....	Northwestern State Normal School.
N. Y....	Albany.....	New York State.		Enid.....	Public.
	Brooklyn.....	Public.		Guthrie.....	Oklahoma State.
	Buffalo.....	Pratt Institute Free.		Langston.....	Colored Agricultural and Normal University.
		Grosvenor.			Public.
	Canton.....	Public.		Miami.....	High School.
	Farmingdale, L. I.	St. Lawrence University.		Muskogee.....	University of Oklahoma.
		State Institute of Applied Agriculture.		Norman.....	Oklahoma State.
	Glens Falls...	Crandall Free.		Oklahoma City	Oklahoma Agricultural and Mechanical College.
	Hamilton.....	Colgate University.		Stillwater....	Murray State School of Agriculture.
	Ithaca.....	Cornell University.	Oreg...	Corvallis.....	Oregon Agricultural College.
	Keuka Park....	Free.		Eugene.....	University of Oregon.
	Newburgh.....	Free.		Forest Grove..	Tualatin Academy and Pacific University.
	New York.....	Astor Branch of New York Public.		Portland.....	Library Association.
		College of the City of New York.			Reed College.
		Columbia University.		Salem.....	Oregon State.
		Lenox Branch of New York Public.	Pa.....	Bradford.....	Carnegie Public.
		New York Law Institute.		Carlisle.....	J. Herman Bosler Memorial.
		New York University.			Public.
		The World.		Erie.....	Pennsylvania College.
	Plattsburg.....	Public.		Gettysburg...	Pennsylvania State.
	Poughkeepsie.	Adrian Memorial.		Harrisburg...	Haverford College.
	Rochester.....	Rochester University.		Haverford....	Juniata College.
	Schenectady...	Union College.		Huntingdon...	
	Syracuse.....	Syracuse University.			
	Troy.....	Public.			
	Utica.....	Public.			
	West Point....	United States Military Academy.			
	Yonkers.....	Public.			

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Pa.....	Lancaster.....	Watts De Peyster Library of F. and M. College.	Tex.....	College Station.	Agricultural and Mechanical College of Texas.
	Meadville.....	Allegheny College.		Dallas.....	Public.
	Norristown.....	William McCann.		El Paso.....	Public.
	Philadelphia.....	Free.		Fort Worth.....	Carnegie.
		Historical Society of Pennsylvania.			Texas Christian University.
		Library Company of Philadelphia.		Galveston.....	Rosenberg.
		Mercantile.		Georgetown.....	Southwestern University.
	Pittsburgh.....	Carnegie.		Houston.....	Lycum and Carnegie.
		University of Pittsburgh.		San Antonio.....	Carnegie.
	Scranton.....	Public.		Waco.....	Baylor.
	South Bethlehem.	Lehigh University.	Utah....	Logan.....	Agricultural College.
	State College..	Carnegie Library of Pennsylvania State College.		Manti.....	High School.
	Reading.....	Reading.		Ogden.....	Carnegie Free.
	Warren.....	Public.		Provo.....	Brigham Young University.
	Washington.....	Memorial Library of Washington and Jefferson College.	Vt.....	Salt Lake City.	University of Utah.
	Wilkes-Barre.	Wyoming Historical and Geological Society.		Burlington.....	Fletcher Free.
P. I.....	Manila.....	Philippine Library and Museum.			University of Vermont.
R. I.....	Kingston.....	Rhode Island College of Agricultural and Mechanical Arts.		Middlebury...	Middlebury College.
	Providence....	Brown University.		Montpelier...	Vermont State.
		Public.		Northfield.....	Carnegie Library of Norwich University.
	Westerly.....	Rhode Island State.	Va.....	Blacksburg...	Virginia Agricultural and Mechanical College and Polytechnic Institute.
S. C....	Charleston....	Charleston Library Society.		Bridgewater...	Bridgewater College.
		Clemson Agriculture College.		Emory.....	Emory and Henry College.
	Clemson College.	Clemson Agriculture College.		Hampden Sidney.	Hampden Sidney College.
	Clinton.....	Presbyterian College of South Carolina.		Lexington.....	Virginia Military Institute.
	Columbia.....	South Carolina State University of South Carolina.			Washington and Lee University.
	Greenwood....	Carnegie Public.		Norfolk.....	Public.
	Orangeburg...	Colored Normal Industrial, Agricultural, and Mechanical College of South Carolina.		Richmond.....	Richmond College.
	Rockhill.....	Winthrop Normal and Industrial College Carnegie.			Virginia State.
S. Dak.	Brookings....	South Dakota State College of Agricultural and Mechanical Arts.		Salem.....	Roanoke College.
	Mitchell.....	Dakota Wesleyan University.		University.....	Virginia University.
	Pierre.....	South Dakota State.		Everett.....	Public.
	Sioux Falls....	Carnegie Free Public.		Olympia.....	Washington State.
	Vermillion....	University of South Dakota.		Pullman.....	State College of Washington.
	Yankton.....	Yankton College.		Seattle.....	Public.
	Chattanooga...	Public.			University of Washington.
	Knoxville.....	University of Tennessee.		Spokane.....	Public.
	Memphis.....	Cossitt.		Tacoma.....	Public.
	Murfreesboro.	Middle Tennessee State Normal.		Walla Walla...	Whitman College.
	Nashville.....	Carnegie.	W. Va..	Charleston...	Department of Archives and History, State.
		Tennessee State.		Elkins.....	Davis and Elkins College.
	Sewanee.....	Yanderbilt University.		Fairmont.....	Normal School.
	Spring Hill....	University of the South.		Institute.....	West Virginia Colored Institute.
		Erasmus and Hughes School.		Keyser.....	Preparatory Branch of West Virginia University.
Tex.....	Austin.....	Texas State.		Morgantown..	West Virginia University.
	Clarendon.....	University of Texas.		Salem.....	Salem College.
		Clarendon College.		Appleton.....	Lawrence University.
				Beloit.....	Beloit College.
				Eau Claire.....	Public.
				Fond du Lac...	Public.
				La Crosse.....	Public.
				Madison.....	State.
					State Historical Society.
				Milwaukee...	Public.
				Racine.....	Public.
				Superior.....	Public.
				Cheyenne.....	Wyoming State.
			Wyo....	Laramie.....	University of Wyoming.
				Sheridan.....	Carnegie Public.

8. ANNOUNCEMENTS OF NEW PUBLICATIONS.

A mailing list is maintained to which is sent at regular intervals the list of titles of new publications. Names will be added to this announcement list on request.

One of the objects of this supplement is to list new publications issued after the latest edition of Circular 24, "Publications of the Bureau of Standards." Such new publications will be listed in the succeeding editions of this supplement until it becomes desirable to revise the complete list given in C24.

SCIENTIFIC PAPERS.

S430. High-Frequency Resistance of Inductance Coils. .

.....*Gregory Breit*

The meaning of the term "resistance" needs careful consideration in the case of high-frequency alternating currents. Difficulties are caused by two effects—the skin effect and the capacity effect. Capacity effects in inductance coils, which are considered in this paper, are caused by the capacities which exist between different portions of the coil, and consist in the collection of charges at points on the wires of the coil, and in the nonuniform distribution of current in the coil which these charges cause. The measured resistance of an inductance coil assumes varying values, depending upon the point with respect to which it is measured. It is shown that if the resistance with respect to all points of the coil is known, then the current at any point of the coil may be computed as soon as the distribution of emf's along the coil is assigned, and a formula is derived for this purpose. Values of current computed by this formula are checked experimentally. The computed value of the resistance is also checked experimentally. (Feb. 24, 1922.) 19 pp. Price, 5 cents.

S431. The Field Radiated from Two Horizontal Coils.

.....*Gregory Breit*

In order to facilitate the landing of airplanes, J. A. Willoughby, of the Bureau of Standards, devised a new type of radio transmitting antenna employing two horizontal coils. The behavior of this transmitting antenna is calculated in this paper. Expressions are derived for the current received in a coil antenna and in an open antenna located at a given distance from and in a given orientation with reference to the transmitting antenna. The variation of signal intensity is computed for the case of an airplane in horizontal flight over the transmitting station, and it is found that if the reception is by means of a vertical coil antenna, then a maximum signal is heard in a position in which the line joining the airplane with the transmitting antenna makes an angle of 35° with the vertical. (Mar. 10, 1922.) 18 pp. Price, 5 cents.

S432. An Improved Method for Preparing Raffinose. .*E. P. Clark*

Owing to the demands made by chemists and bacteriologists for specifications and standards for raffinose, a convenient and economical method for its preparation has been developed. Cottonseed meal is extracted from water, the liquor freed from impurities with basic lead acetate, and the raffinose present removed from the liquid as an insoluble lime compound. This raffinosate is decomposed with CO_2 and the free sugar resulting is crystallized from its concentrated sirup by means of alcohol. A device for carbonating, which is useful for many other purposes, is also described. (Apr. 8, 1922.) 4 pp. Price, 5 cents.

S433. Thermal Expansion of a Few Steels.....

.....*Wilmer Souder and Peter Hidnert*

The critical regions of steel are used as a basis for heat treatment in securing or retaining desirable quantities, such as hardness, elastic properties, tensile strength, etc. Data are presented in tabular form and in curves showing the dimensional changes of steel in passing through these regions. Electrolytic iron and cast iron are also included. One specimen of hardened steel is analyzed, by dimensional changes, to show the release of strains on heating. (Apr. 10, 1922.) 16 pp. Price, 5 cents.

S434. Electromotive Force of Cells at Low Temperatures..

.....*G. W. Vinal and F. W. Altrup*

The practical importance of a knowledge of the electromotive behavior of dry cells and storage batteries at low temperatures has arisen from their use in the Arctic and at high altitudes. Measurements were made on dry cells and storage batteries cooled to 72° C. by carbon dioxide snow and to 170° C. by the use of liquid air. The Gibbs-Helmholtz equation was applied to the observations, and excellent agreement between theory and observation found. At the lowest temperatures high values of voltage were sometimes observed and the polarity often reversed. A possible explanation based on the Nernst equation is given. (Apr. 17, 1922.) 8 pp. Price, 5 cents.

S435. Metallographic Etching Reagents: II. For Copper Alloys, Nickel, and the Alpha Alloys of Nickel.

.....*Henry S. Rawdon and Marjorie G. Lorentz*

This investigation constitutes the second part of the general study of metallographic etching reagents. Specimens representative of all of the types of alloys in the copper-zinc system and of the industrial bronzes and of aluminum bronze were examined. The etching characteristics of brasses and bronzes are very similar to those of copper (S399) in that oxidation plays a very important part. Nickel is etched with very considerable difficulty, contrast is usually lacking, and pitting is apt to be excessive. A new reagent, concentrated by hydrochloric acid, is described for etching this material, by means of which very superior results may be obtained. The alpha nickel alloys are etched much more readily than is the metal itself, particularly the nickel brasses. (Apr. 27, 1922.) 42 pp. Price, 15 cents.

S436. Interference Methods for Standardizing and Testing Precision Gage Blocks..

.....*C. G. Peters and H. S. Boyd*

With the interference methods described in this paper the planeness and parallelism errors of precision gage surfaces can be measured and the length of standard gages determined by direct comparison with the standard light waves with an uncertainty of not more than a few millionths of an inch. The errors of other gages can be determined by comparison with these calibrated standards, with equal precision. (May 2, 1922.) 37 pp. Price, 10 cents.

S437. The Solubility of Dextrose in Water.....

.....*Richard F. Jackson and Clara Gillis Silsbee*

The equilibria in the system, dextrose and water, have been determined. For temperatures below 90° C. three solid phases are capable of existence, namely, ice, α -dextrose monohydrate, and anhydrous-dextrose. The

cryohydric point lies at the temperature -5.3°C. and concentration 31.7 per cent dextrose. The solid phase, α -dextrose, monohydrate, which occurs in lustrous plates, is stable between -5.3 and 50°C. Its solubility shows a very high temperature coefficient. The observed melting point, $80-90^{\circ}\text{C.}$, although located far from the extrapolated solubility curve, is shown to be compatible with the measurements. The anhydrous form, stable above 50°C. , has a small solubility temperature coefficient. The solubility measurements of this phase in metastable state were continued down to 28°C. (May 5, 1922.) 10 pp. Price, 5 cents.

S438. Tests of Stellar Radiometers and Measurements of
the Energy Distribution in the Spectra of 16
Stars.....*W. W. Coblentz*

An account is given (1) of the new tests of stellar radiometers, (2) of new measurements of the total radiation of stars, (3) of the spectral energy distribution in the complete spectrum of a star as determined by means of transmission screens, and (4) of estimates of the temperature of stars as determined from the spectral energy measurements. These radiation measurements indicate spectral energy distribution equivalent to that of a black body at $3,000^{\circ}\text{K}$ for red stars to $10,000^{\circ}\text{K}$ for blue stars. (May 12, 1922.) 26 pp. Price, 10 cents.

S439. Sensitometry of Photographic Emulsions and a
Survey of the Characteristics of Plates and
Films of American Manufacture.....
.....*R. Davis and F. M. Walters, jr.*

The properties of photographic emulsions are discussed from the standpoint of the relation between density and exposure, the growth of contrast with development, color sensitiveness, resolving power, and fogging in development. The apparatus used in testing photographic material at the Bureau of Standards is described. Charts are given of 90 negative emulsions made in the United States. These charts show the characteristic curves, the rate of development curve, the growth of fog with contrast, the color sensitiveness, the filter factors, the speed, the resolving power, and scale of the various plates and films. (May 5, 1922.) 120 pp. Price, 35 cents.

S440. The Spectral Transmissive Properties of Dyes: I.
Seven Permitted Food Dyes, in the Visible,
Ultra-Violet, and Near Infra-Red.....
*K. S. Gibson, H. J. McNicholas, E. P. T.
Tyndall, M. K. Frehafer, and W. E. Mathewson*

In this paper is presented the outline of an investigation of the spectral transmissive properties of dyes. The plans and purposes of this investigation are discussed, the methods and apparatus used to obtain the data described, and a tentative nomenclature presented. Four methods are used in the experimental work: (1) the visual method, using the König-Martens spectrophotometer; (2) the photographic method, with the Hilger sector photometer; (3) the photoelectric null method; and (4) the thermo-

electric method. The total range of measurement is from 240 to 1,360 millimicrons.

As a beginning, and to illustrate the methods of obtaining and presenting the data, the transmittances of seven permitted food dyes have been obtained in the visible, ultra-violet, and near infra-red spectral regions, at different concentrations, thicknesses, and temperatures. Discussion of the analytical and theoretical applications of the data is postponed until more data are available. (May 15, 1922.) 64 pp. Price, 15 cents.

S441. Notes on Standard Wave Lengths, Spectrographs,
and Spectrum Tubes.

.....*W. F. Meggers and Keivin Burns*

I. Standard wave lengths in the cadmium spectrum are presented in the range 2980 to 5085 Å. The values for 13 lines are given relative to the primary standard and are thought to be correct to one part in several millions.

II. A quartz rock salt spectrograph designed for the purpose of photographing interference phenomena in the ultra-violet is described.

III. The characteristics and performance of a stigmatic concave grating mounting are outlined, and detailed drawings of the apparatus are reproduced.

IV. Instructions and suggestions are given for the preparation of spectrum tubes commonly required for optical demonstration, testing, or research. (May 24, 1922.) 15 pp. Price, 5 cents.

S442. Wave-Length Measurements in the Arc Spectra of
Neodymium and Samarium.

.....*C. C. Kiess*

This paper contains about 3,000 wave lengths measured in the arc spectra of neodymium and samarium between 5475 Å in the green and 9200 Å in the infra-red. A supplementary list contains about 125 lines common to the spectra of both elements. They may be characteristic of the element coming between neodymium and samarium, but not yet isolated. A large concave grating spectrograph was used for the work, the photographic plates being suitably sensitized for the regions investigated. The materials used were neodymium oxalate and samarium oxide prepared at the University of Illinois and samarium oxalate prepared at New Hampshire College. (June 1, 1922.) 19 pp. Price, 5 cents.

S443. Measurement of the Color Temperature of the More
Efficient Artificial Light Sources by the
Method of Rotatory Dispersion.

.....*Irwin G. Priest*

A description of measurements of color temperature by the method of rotatory dispersion for color temperatures between 3,000 and 4,000° absolute centigrade. Quantitative data are given on (1) comparison of color temperature scales at the Bureau of Standards and the Nela Research Laboratory, (2) the color temperature of the gas-filled tungsten lamp as a function of efficiency up to the melting point of tungsten, and (3) the color temperature of the carbon arc. (July 24, 1922.) 14 pp. Price, 5 cents.

S444. Practical Spectrographic Analysis. *W. F. Meggers*

A brief review of various methods which have been proposed for chemical analyses by means of the spectrum is followed by a detailed description of the principle, apparatus, and procedure employed in making quantitative analyses from the spectra of condensed sparks. The practical application of this method is illustrated by three samples taken from the work of the spectroscopy section of the Bureau of Standards and deals with the quantitative determination of impurities in various samples of tin, gold, and platinum. Other applications to problems in chemistry, metallurgy, mineralogy, physics, biology, etc., are suggested. (July 29, 1922.) 21 pp. Price, 10 cents.

S445. A Piezo Electric Method for the Instantaneous
Measurement of High Pressures. *J. C. Karcher*

A number of quartz plates suitably cut are arranged, condenser fashion, in a stack and introduced in an electric circuit. The quartz plates are subjected by means of a piston to the gas pressure to be measured. The combination of these constitutes a gauge which is screwed into the wall of the gas chamber, and the leads are brought out through holes drilled through the wall. A ballistic galvanometer whose period is long compared to the duration of the pressure phenomenon is connected to the electrodes of the quartz plates. The galvanometer deflections are photographically recorded on a rapidly moving film. The pressure-time curve is the differential of the recorded deflection-time curve. (Aug. 4, 1922.) 8 pp. Price, 5 cents.

S446. Spectrophoto-electrical Sensitivity of Argentite. .
. *W. W. Coblenz*

The present paper on argentite (isometric crystal) in connection with a previous paper (B. S. Sci. Paper No. 344) on acanthite (orthorhombic crystal) constitutes a study of spectrophotoelectrical sensitivity as affected by crystal structure. The paper gives experimental data on the effect of temperature, of the intensity of the radiation stimulus, and of mechanical working of the material upon photoelectrical sensitivity. From the data presented it is concluded that crystal structure has a marked effect upon spectrophoto-electrical sensitivity. (Aug. 18, 1922.) 16 pp. Price, 5 cents.

S447. Theory, Construction, and Use of the Photometric
Integrating Sphere. *E. B. Rosa and A. H. Taylor*

Part I deals with the materials and construction of various spheres, and describes in detail the construction of a reinforced concrete sphere at the Bureau of Standards. It gives tests of the accuracy of integration by this sphere, the absorption of light by the sphere coating and by objects in the sphere, and the effect of the position of lamps. Proper methods of operation are also outlined.

Part II gives a fairly complete resumé of the general theory of the sphere, with the addition of a considerable amount of new material, showing how to test the accuracy of the sphere, and how to improve the accuracy of integration. It also gives a bibliography of the subject. (Aug. 28, 1922.) 45 pp. Price, 10 cents.

S448. The Decarburization of Ferrochromium by Hydrogen *Louis Jordan and F. E. Swindells*

The recent development of stainless or rustless iron—a very low-carbon stainless steel—has emphasized the demand for inexpensive, low-carbon ferrochromium. Methods of refining high-carbon ferrochromium are reviewed. Several investigations of the decarburization of iron and steel by heating in hydrogen have been reported in the literature. A similar method for the decarburization of high-carbon ferrochromium has been proposed. Decarburization takes place slowly when solid ferrochromium is heated in hydrogen at or above $1,100^{\circ}\text{C}$. The most rapid decarburization was secured by blowing hydrogen through molten ferrochromium. (Sept. 15, 1922.) 8 pp. Price, 5 cents.

S449. Radio-Frequency Amplifiers *P. D. Lowell*

The use of radio-frequency amplification makes it possible to receive very feeble signals which without such amplification can not be heard at all. For satisfactory reception with coil antennas, such as those used in direction-finding work, radio-frequency amplification is necessary. There are three important methods by which the stages of a radio-frequency amplifier may be coupled—resistance coupling, tuned-plate coupling, and transformer coupling. This paper discusses each of these methods, particularly the last method, and gives circuit diagrams and constructional details. The construction of the radio-frequency transformers and other accessory devices required in constructing the amplifier is described. Descriptions are given of radio-frequency transformers having iron cores of thin steel laminations, as well as air-core transformers. (Oct. 2, 1922.) 9 pp. Price, 5 cents.

S450. An Electron-Tube Amplifier Using Sixty-Cycle Alternating Current to Supply Power for the Filaments and Plates *P. D. Lowell*

Electron-tube amplifiers now form an important part of practically all radio receiving sets. The usual types of electron-tube amplifiers in general use require storage batteries and dry batteries to supply power. This paper describes the development of a special type of amplifier which uses 60-cycle alternating current from the ordinary lighting mains as a source of power for both the filaments and plates. The final form of the amplifier has three stages of radio-frequency amplification—a crystal detector and two stages of audio-frequency amplification. The inconvenience and expense of storage batteries and dry batteries are eliminated. Complete circuit diagrams are given. (Oct. 2, 1922.) 8 pp. Price, 5 cents.

S451. Spectrophoto-electrical Sensitivity of Bournonite and Pyrargyrite . . . *W. W. Coblenz and J. F. Eckford*

The present paper in connection with previously published data on proustite (Sci. Paper No. 412) represents a study of the effect of chemical constitution upon spectrophoto-electrical sensitivity. Experimental data are given on the effect of temperature and of the intensity of the radiation stimulus upon the spectrophoto-electrical sensitivity of bournonite and pyrargyrite. The results obtained are in agreement with the previously formulated (Sci. Paper No. 398) general characteristics of spectrophoto-electrical conduction in solids. (Oct. 3, 1922.) 20 pp. Price, 10 cents.

- S452. The Structure of Martensitic Carbon Steels and the Changes in Microstructure which Occur upon Tempering. . . . *Henry S. Rawdon and Samuel Epstein*

A study of the microstructural changes produced in hardened steels by tempering was carried out in a series of six carbon steels (0.07 to 1.12 per cent carbon). The characteristic features in the visible structure of martensite are discussed, and the changes caused by heating are considered with reference to the thermal transformation in hardened steels which occurs at approximately 250° C. The microscopic study was supplemented by determinations of the scleroscope hardness, and the results were found to confirm and support the conclusions which the study of the structure appeared to warrant. (Oct. 9, 1922.) 37 pp. Price, 15 cents.

- S453. The Preparation and Properties of Pure Iron Alloys: I. Effects of Carbon and Manganese on the Mechanical Properties of Iron.
 *Robert P. Neville and John R. Cain*

This paper describes the preparation and mechanical properties of a series of very pure alloys of electrolytic iron, carbon, and manganese, whose compositions were so chosen as to bring out the specific effects on pure iron of additions of carbon, additions of manganese, and additions of carbon and manganese together in varying relative proportions. The maximum content each of carbon and manganese is about 1.5 per cent; the minimum, 0 per cent, or pure iron. Three-pound ingots of the alloys were made by fusion under vacuum in an electric furnace. From these ingots test specimens were made and tested in the annealed state. The influence of carbon and manganese on the mechanical properties of the alloys is shown by curves. (Oct. 16, 1922.) 33 pp. Price, 10 cents.

- S454. The Action of Charred Paper on the Photographic Plate and a Method of Deciphering Charred Records. *Raymond Davis*

A method is given for obtaining a copy of the written and printed matter on paper records that have been charred. The charred paper is placed between two fast photographic plates and kept in total darkness for one or two weeks. On development in the usual manner a copy is obtained of the ink writing and printing. It appears that the gases from the charred paper have the property of fogging the plate, the ink acts as a screen, hindering the escape of the gases. (Oct. 18, 1922.) 6 pp. Price, 5 cents.

- S455. Tables for the Calculation of the Inductance of Circular Coils of Rectangular Cross Sections. *Frederick W. Grover*

Formulas for the calculation of inductance are usually rather complicated, and computations are tedious and time consuming. Furthermore, the choice of the proper formula for a given problem is often difficult. When many calculations have to be made, tables for facilitating the calculations are practically indispensable. This paper presents tables, based on accurate known formulas, for the calculation of inductance in the very important case of circular coils of rectangular cross section. By their aid

the computation of the inductance is reduced to the simplest arithmetical operations. The method of using the tables is thoroughly explained and illustrated by examples. (Oct. 28, 1922.) 37 pp. Price, 10 cents.

S456. Spectrophoto-electrical Sensitivity of Some Halide

Salts of Thallium, Lead, and Silver.

..... *W. W. Coblenz and J. F. Eckford*

The present paper, in connection with previous papers (Sci. Papers Nos. 451 and 462), completes a study of the effect of crystal structure, chemical constitution, and atomic weight upon photo-electrical reaction spectra. Spectrophoto-electrical sensitivity data are given on the chloride, bromide, and iodide of thallium and of silver, and the iodide of lead. The photoelectrical reaction of these salts is confined to a very narrow region of the violet end of the spectrum. The effect of increasing the atomic weight of the acid element is to shift the maximum of the photo-electrical reaction toward the long wave length. (Nov. 8, 1922.) 10 pp. Price, 5 cents.

S457. Gases in Metals: I. The Determination of Combined Nitrogen in Iron and Steel and the Change in Form of Nitrogen by Heat Treatment.

..... *Louis Jordan and F. E. Swindells*

The nitrogen determined by the Allen method in iron alloys is that present as combined or nitride nitrogen. This method of analysis is described, and sources of errors are discussed. An increase in the amount of combined nitrogen was found to occur with heat treatment of certain irons and steels. It is probable that this increase in combined nitrogen is the result of the conversion of uncombined nitrogen to nitride nitrogen by heat treatment, and that nitrogen in two forms was originally present in the samples in which the increase took place. (Nov. 8, 1922.) 13 pp. Price, 5 cents.

S458. Apparatus for the Determination of the Magnetic

Properties of Short Bars. *M. F. Fischer*

This paper describes the method and apparatus developed for the magnetic testing of cylindrical samples 6 mm in diameter and 10 cm in length. The method consists of a comparison of the test sample with a reference bar whose properties have been previously determined by calibration. The induction is measured by a test coil surrounding the specimen. The magnetizing force for any induction is that indicated by the corresponding induction in the reference bar and is read from the calibration curve. Values of magnetizing force corresponding to a given induction can, in general, be measured to within 5 per cent of the correct value for most materials. (Nov. 15, 1922.) 14 pp. Price, 5 cents.

S459. The Structure of Fucose. *E. P. Clark*

The complete structure of fucose has not hitherto been known, the position of the hydroxyl group on carbon atom 5 being the part in doubt. In order to clear up this point, a lactone of the methyl tetronic acid has been prepared, and from its optical properties the position of the hydroxyl group on carbon atom 4 of this substance, corresponding to carbon atom 5 of fucose, has been established, thus giving the complete structure of fucose. The position of the hydroxyl groups on carbon atoms 2, 3, and 4 of fucose has also been verified by a study of the optical properties of the amides of the methyl tetronic acid and of fuconic acid (prepared for the first time), together with fuconic lactone. An improved method for preparing fucose is also recorded. (Nov. 22, 1922.) 8 pp. Price, 5 cents.

S460. Further Tests of Stellar Radiometers and Some Measurements of Planetary Radiation *W. W. Coblentz*

Improvements are described in the radiometric apparatus used in measuring the radiation from celestial objects. Data are given on the radiations emitted by planets due to warming by solar radiation and due to a possible high internal temperature; also a verification of the stellar temperatures by means of transmission screens described in B. S. Sci. Papers, No. 438. The intensity of the planetary radiation, in per cent of the total radiation from a planet, is as follows: Jupiter (o), Venus (5), Saturn (15), Mars (30), and the moon (80).

The measurements obtained on the sun verify previous data indicating stellar temperatures ranging from 3,000° K for red, class M stars, to 12,000° for blue, class B stars. (Dec. 23, 1922.) 24 pp. Price, 10 cents.

S461. Spherical Aberration of Thin Lenses. . *T. Townsend Smith*

This article presents the elementary theory of thin lenses, gives means for determining quickly the aberration of any thin lens for any position of the object and formulates conditions under which spherical aberrations of two thin lenses will compensate one another. A graphical solution of the problem as to the conditions under which a two-piece lens may be achromatic, free from axial spherical aberration and free from coma is included, and the shapes of lenses necessary to satisfy these different conditions are shown. (Dec. 27, 1922.) 26 pp. Price, 10 cents.

S462. Various Photo-electrical Investigations. . *W. W. Coblentz*

Data are given upon: (1) The photo-electrical sensitivity of artificial preparations of molybdenum sulphide; (2) the effect of heat and electrical treatment upon the photo-electrical sensitivity of molybdenite and stibnite; (3) various artificial preparations; (4) positive and negative photosensitivity; (5) spectral response curve of Case's barium and strontium photo-electric cells; also of cuprous oxide, of lead antimony sulphide and of iodine; and (6) spectroscopic and chemical analyses of photosensitive and nonsensitive molybdenite. (Dec. 27, 1922.) 23 pp. Price, 10 cents.

S463. Preparation and Properties of Pure Iron Alloys:

II. Magnetic Properties of Iron-Carbon Alloys
as Affected by Heat Treatment and Carbon

Content. *W. L. Cheney*

A study of the variations of the magnetic properties of unusually pure iron-carbon alloys due to (1) heat treatment, viz, (a) hardening by quenching from temperatures above the critical range, and then drawing back to successively higher temperatures, (b) carefully annealing in vacuo; and (2) carbon content. The hardened alloys show certain magnetic transformations when drawn back to higher temperatures, which correspond to metallographic transformations. Comparing the magnetic properties with the carbon content, there are found certain changes in these properties as the percentage of carbon content is increased. The reluctivity relationship is employed to predict the number of metallographic constituents present in the material. (Dec. 27, 1922.) 27 pp. Price, 15 cents.

S464. Preparation and Properties of Pure Iron Alloys:
 III. Effect of Manganese on the Structure of
 Alloys of the Iron-Carbon System.....

.....*Henry S. Rawdon and Frederick Sillers, jr.*

Manganese plays at least three rôles in carbon steels, as deoxidizer, "desulphurizer," and as a hardener. This investigation deals with the third. The effect of manganese upon the structure was determined for an extensive series of alloys, C, 0 to 1.6; Mn, 0 to 2 per cent. The general effect of manganese may be described as a "restraining influence," so that even after annealing, steels have the structure and properties ordinarily found in similar steels of low manganese content after more rapid cooling. Manganese confers upon pearlite a fine grained sorbitic structure and lowers the eutectoid ratio by approximately 0.12 per cent for each per cent of added manganese. After normalizing, specimens high in manganese were much finer grained than those low in manganese; no difference in the annealed specimens was noted, however. (Dec. 27, 1922.) 17 pp. Price, 10 cents.

S465. Composition, Purification, and Certain Constants
 of Ammonia.....*E. C. McKelvy and C. S. Taylor*

Chemical tests made on eight standard American brands of commercial ammonia indicate that most commercial brands contain less than 0.1 per cent of impurities. Choosing the best commercial samples as a starting point for further purification, 15 samples were prepared, by numerous fractional distillations, for use in the determination of the various thermodynamical properties of ammonia. These samples were found to contain less than 0.01 per cent, by weight, of water from approximately 1 part in 10,000 to 1 part in 1,000,000, by volume, of noncondensing gases, and less than 0.001 per cent of other impurities. Determinations were made of the density of the solid, freezing point, and vapor pressure at the triple point. (Mar. 9, 1923.) 39 pp. Price, 10 cents.

S466. Wave Length Measurements in the Arc Spectra of
 Gadolinium and Dysprosium.....*C. C. Kiess*

Very pure gadolinium oxide and dysprosium oxalate prepared at the University of Illinois were used in studying the arc spectra of these elements from the green (5500A) out into the infra-red spectral regions. About 950 lines belonging to Gd and about 800 belonging to Dy have been tabulated. Most of these lines are faint. A band spectrum is emitted faintly by each element. (Mar. 12, 1923.) 12 pp. Price, 5 cents.

S467. Specific Volume of Saturated Ammonia Vapor
*C. S. Cragoe, E. C. McKelvy, and G. F. O'Connor*

This paper describes the measurement of the specific volume of ammonia vapor under saturation conditions in the temperature interval -50 to $+50^{\circ}$ C. by two methods—one, involving a direct determination of the mass of the vapor contained in a known volume; and the other, an optical method, involving measurements of the index of refraction of the vapor. The experimental results are shown to be in fair agreement with values obtained by computation from other measured thermodynamic properties of ammonia. Tables in both metric and English units are appended. (Mar. 17, 1923.) 29 pp. Price, 5 cents.

S468. Formulas and Tables for the Calculation of the
Inductance of Coils of Polygonal Form
.....*Frederick W. Grover*

Inductance coils wound on forms such that each turn of the coil incloses a regular polygon have the advantage that, on account of the small amount of dielectric necessary for the support of the wires, energy losses in the dielectric may be made very small. In this paper formulas are derived for the calculation of the inductance of such coils, both for a single layer winding and for a multilayer winding. Tables which give the radius of a circular coil having the same inductance as the given polygonal coil are included. These enable the calculation of the inductance to be carried out by means of the existing formulas and tables for circular coils. (May 3, 1923.) 26 pp. Price, 10 cents.

S469. Directive Radio Transmission on a Wave Length
of 10 meters.
.....*Francis W. Dunmore and Francis H. Engel*

Two important means of reducing interference in radio communication are the use of short wave lengths, such as 10 m, and the use of directive types of antennas which will direct a beam of radiated waves toward the receiving station with which it is desired to communicate. Experiments embodying both of these methods have been conducted at the bureau with an electron-tube transmitting set and a directive reflecting antenna, consisting of short vertical wires arranged as the elements of a parabolic cylinder, using a wave length of 10 m. Each of the vertical wires was tuned separately to the radiated wave length, and the source was placed at the focus of the parabola. The radiated wave was found to be confined to an angle of about 40° . The paper gives construction details concerning the apparatus and circuits used, so that anyone may duplicate the results described. (Apr. 11, 1923.) 16 pp. Price, 10 cents.

S470. A Method for the Accurate Measurement of
Short-Time Intervals.
.....*Harvey L. Curtis and Robert C. Duncan*

A method is described whereby small intervals of time between events, whose occurrence can be recorded on a moving photographic film, may be determined with a high degree of accuracy. The method consists in ruling on the moving film a uniform time scale, simultaneously with the recording of the events to be studied. The time scale is obtained by throwing flashes of light on the film from a shutter controlled by a tuning fork. The paper discusses in considerable detail the type of optical system used, the necessary conditions for the most satisfactory timing lines, the sources of error inherent in the method, and the accuracy with which various time intervals can be measured. (Apr. 26, 1923.) 22 pp. Price, 10 cents.

- S471. Methods of Measurement of Properties of Electrical Insulating Materials.
 *J. H. Dellinger and J. L. Preston*

The Bureau of Standards has received frequent requests for information on the methods that have been found practicable in making measurements of properties of electrical insulating materials. This paper describes the various methods in use at the bureau. They include phase difference and dielectric constant, voltage effects at radio frequencies, electrical resistivities, density and moisture absorption, tensile strength, transverse strength, hardness, impact, strength, permanent distortion, machining qualities, thermal expansivity, and effects of chemicals. (May 2, 1923.) 34 pp. Price, 15 cents.

- S472. Alternating-Current Resistance and Inductance of Single-Layer Coils. *C. N. Hickman*

Formulas for the alternating-current resistance and inductance of single-layer coils are developed by use of an integral equation method. The formulas are applied to coils in which the skin effect is quite pronounced. The resistance and inductance of the coils are measured at several frequencies, and the results compared with the computed values. A simple formula for the mutual inductance of coaxial circles of the same diameter is also developed. (May 3, 1923.) 32 pp. Price, 10 cents.

- S473. A Method for the Measurement of Sound Intensity. *J. C. Karcher*

A sound-detecting device, such as a magnetophone or electrostatic transmitter, and two coils, whose mutual inductance can be varied by known amounts, constitutes a measuring instrument. The sound detector and one coil are connected to an indicating instrument, consisting of a vacuum-tube amplifier, a rectifier, and galvanometer. The emf generated in the detecting instrument is compared by substitution with emf generated in one coil when the other carries a known current. Since the sound intensity is proportional to the square of the emf generated in the detector, a means of making sound intensity measurements is presented. The necessity for the calibration of an amplifier is obviated. The instrument has a sensitivity range of about a millionfold. (May 7, 1923.) 7 pp. Price, 5 cents.

- S474. Series in the Arc Spectrum of Molybdenum. . *C. C. Kiess*

Analysis of the arc spectrum of Mo reveals the fact that the stronger lines belong to triplets and multiplets. The triplets have been arranged into series, and formulas of the Ritz type have been found for them. From the series limits have been calculated the resonance and ionization potentials which are of importance in certain physical and astronomical problems. The multiplets consist of 9 and 13 lines, and have been found to arise from interorbital transitions of the valence electron similar to those which result in the emission of the triplet series. (July 10, 1923.) 17 pp. Price, 10 cents.

S475. The Visibility of Radiant Energy.....
 *K. S. Gibson and E. P. T. Tyndall*

In cooperation with the Nela Research Laboratories a new determination of the visibility of radiant energy has been made by the step-by-step method, an equality-of-brightness method with little or no hue difference in the photometric field. Fifty-two observers were used, some of them common to previous investigations. The final values are similar to those obtained by other investigators. There seems to be no certain difference between the values of visibility obtained by the flicker and equality-of-brightness methods, provided the former is used under conditions as recommended by Ives and the latter does not depart too widely from these conditions. A revision of the I. E. S. mean curve is proposed which results in better agreement with the average experimental visibility data. (Aug. 11, 1923.) 61 pp. Price, 15 cents.

S476. A Study of Radio Signal Fading.....
 *J. H. Dellinger, L. E. Whittemore, and S. Kruse*

One of the difficulties encountered in radio communication at very high wave frequencies or short wave lengths, is the so-called fading of the received signals. This paper describes some tests which were made by the Bureau of Standards in cooperation with the American Radio Relay League. The observations reported by a large number of observers were analyzed and conclusions drawn as to possible relations between weather conditions and the fading and intensity of radio signals. The reports also included notes regarding the intensity of strays or atmospheric disturbances. (Sept. 25, 1923.) 40 pp. Price, 10 cents.

S477. Spectroradiometric Analysis of Radio Signals....
 *Chester Snow*

If a radio signal is repeated at regular intervals, it will produce in a simple receiving circuit a current whose effective value may be measured. By varying the capacity in this circuit, it may be tuned successively to all frequencies within a given range, and the induced current observed. Since the circuit responds not to one frequency alone, but in varying degrees to all frequencies in a certain interval, there is some confusion in the record, caused by this overlapping. This article shows how to derive from such a record the spectral distribution of energy in the incoming wave. The method will be useful in studying the radiation actually sent out by a radio station in order to determine its interference producing qualities. (Oct. 22, 1923.) 32 pp. Price, 10 cents.

TECHNOLOGIC PAPERS.

T208. Weighing by Substitution . . . *C. A. Briggs and E. D. Gordon*

This paper describes a plan for making accurate substitution weighings, applicable either to equal arm balances or compound lever scales, that has been developed in connection with the standardization of large weights of the Bureau of Standards. It has been prepared to meet a demand for an explanation of substitution weighing which has come from practical scale men in the field who have seen the plan used by the representatives of the bureau and who desire to adopt it. The description, however, will also be of interest and value to many workers in engineering and other laboratories who have occasion to weigh large objects accurately. A record form and computation sheet is presented which it will be found advantageous to follow. (Feb. 21, 1922.) 16 pp. Price, 5 cents.

T209. Thermal Stresses in Chilled Iron Car Wheels

. *G. K. Burgess and R. W. Woodward*

A method is described for testing car wheels in the laboratory under conditions approximating the application of brakes on long grades and for measuring the stresses developed in the wheels due to the heating of the tread while the hub is cool. Twenty-eight wheels were tested in this manner, of which 16 failed by cracking in the plate. The maximum stresses measured were approximately equal to the tensile strength of the iron, or about 26,000 pounds per square inch. (Mar. 18, 1922.) 34 pp. Price, 5 cents.

T210. The Redwood Viscometer *Winslow H. Herschel*

The Redwood viscometer is the standard instrument in England for determining the viscosity of lubricating oils. By methods of calibration explained in previous papers (T100, T112, T125) the equation was obtained

$$\text{kinematic viscosity} = .00260 t - \frac{1.88}{t}$$

where t is the time of flow in seconds. This equation makes it possible to calculate tables for converting Redwood readings into readings of any other instrument for which a similar equation has been determined. (Apr. 10, 1922.) 20 pp. Price, 10 cents.

T211. Radiators for Aircraft Engines

. *S. R. Parsons and D. R. Harper, 3d*

The characteristics which determine the value of the radiator in discharging its functions are considered in detail. Measurements of air flow through the core, of head resistance, of cooling power, and of geometrical characteristics are described and an exposition given of the relations between these and the conditions under which a radiator operates and its characteristics of form and construction. The work was based on special laboratory investigations, including laboratory tests of over 100 types of radiator core. A detailed record of the performance of these cores is included in the paper. (May 25, 1922.) 184 pp. Price, 50 cents.

T212. Carbon Monoxide in the Products of Combustion
from Natural Gas Burners.....

.....*I. V. Brumbaugh and G. W. Jones*

Carbon monoxide is liberated with the products of combustion from natural gas burners in quantities that are dangerous to health if the flame is insufficiently aerated and the room is poorly ventilated. The quantities depend upon (1) distance of the utensil above the burner, (2) height of blue inner cone of flame, (3) type of burner, (4) flame characteristic (ratio of volume of primary air injected into burner relative to volume of gas consumed), (5) rate of consumption of gas per hour. No carbon monoxide was found where the distance of the utensil from the burner was such that the blue inner cone of the flame did not touch the utensil. Ventilation is especially important where gas is consumed. A natural gas flame will smother out if the oxygen of the atmosphere has been reduced to about 15.5 per cent. (May 1, 1922.) 20 pp. Price, 10 cents.

T213. Power Losses in Automobile Tires.....

.....*W. L. Holt and P. L. Wormeley*

This paper describes the dynamometer equipment used to measure the power loss or energy dissipated into heat in automobile tires operated under different conditions of axle load, inflation, pressure, speed, temperature, and tractive effort. The influence of these factors on power losses is shown graphically. (May 5, 1922.) 11 pp. Price, 5 cents.

T214. Durability of Cement Drain Tile and Concrete in
Alkali Soils: Third Progress Report (1919-
20).....

.....*G. M. Williams*

This paper reports the results of inspection in 1919 and 1920 of experimental drain tile and concrete block installations at eight alkali-bearing projects in the West. The investigation has been carried on since 1913, and the conclusions to date are that the best quality of concrete will disintegrate when exposed to severe alkali attacks, and that installations of concrete in soils containing more than 0.1 per cent of salts of the sulphate type should be preceded by an examination of surrounding conditions. (May 19, 1922.) 32 pp. Price, 10 cents.

T215. Durability of Sole Leather Filled with Sulphite
Cellulose Extract.....

.....*Roy C. Bowker*

This paper describes the preparation and testing of four lots of leather used to determine the comparative durability of sole leather filled with sulphite cellulose extract and sole leather filled with the ordinary tanning materials, such as chestnut wood extract and quebracho extract. Physical data obtained from actual service tests and chemical analyses of both the new and worn soles are presented. It is concluded that there is no difference in quality between the two leathers as reflected by the chemical analyses, and that sole leather filled with sulphite cellulose extract is as durable as leather filled with chestnut and quebracho extracts. (June 10, 1922.) 6 pp. Price, 5 cents.

T216. Properties of Electrical Insulating Materials of the Laminated Phenol-methylene Type.....

.....*J. H. Dellinger and J. L. Preston*

A study has been made of the electrical properties and some of the mechanical properties of insulating materials of the laminated phenol-methylene type, such as are used in radio apparatus. The measurements include power loss at radio frequencies, dielectric constant, flash-over voltage, volume and surface resistivity, thermal expansivity, density, moisture absorption, tensile and transverse strength, elasticity, hardness, impact strength, effect of acids and alkalies, and machining properties. The materials studied were Formica, grades M, M-2, P, and R; Bakelite Dilecto, grades XX, X, and Continental Bakelite; Bakelite Micarta, grades 32-X, 21-X, 323, 213, and 21-D; and Condensite Celoron, grades 10, 15, and 20. (July 21, 1922.) 127 pp. Price, 30 cents.

T217. Photomicrography of Paper Fibers.....*R. E. Lofton*

This paper reports an investigation of the efficiency of the incandescent light as a source of illumination in photomicrography, of the value of light filters, of the proper use of the substage condenser and diaphragm, of the advantages of a camera with a long bellows over one having a short bellows, of the value of staining, choice of objectives, etc. The publication contains 30 figures, including 22 photographs and photomicrographs illustrating the points in question. (Aug. 2, 1922.) 22 pp. Price, 5 cents.

T218. Results of Some Compression Tests of Structural

Steel Angles.....*A. H. Stang and L. R. Strickenberg*

This article presents the results of compression tests of 170 structural angles, made at the Pittsburgh branch, Bureau of Standards. The object of the tests was to determine the ultimate compressive strength of angles fastened at the ends in such way as would closely correspond to their connections in the construction of transmission towers. There was also tested a series of angles with square ends. An end fixation factor was found to represent satisfactorily the effect of different types of end connections. Using this fixation factor, the average values for large slenderness ratios were well represented by Euler's formula. The results obtained from shorter columns agreed with the experimental and theoretical results of Karman. The effect of eccentric loading was most marked at the slenderness ratios indicated by Karman's theory. (Aug. 3, 1922.) 17 pp. Price, 10 cents.

T219. Effect of Temperature, Deformation, and Rate of Loading on the Tensile Properties of Low-Carbon Steel below the Thermal Critical

Range.....*H. J. French*

This paper gives results of tensile tests at temperatures up to 465° C. of several grades of boiler plate, describing special apparatus used. Determination of the effects of cold and blue work on the properties of these steels throughout the range given is described. Included also are results showing the effect of tensional elastic overstrain on the elasticity of different temperatures and its recovery with time. Effects of variation in rates of loading are described, together with a special apparatus, using a motion-picture camera for the work. (Aug. 22, 1922.) 47 pp. Price, 10 cents.

T220. Test of a Hollow Tile and Concrete Floor Slab
Reinforced in Two Directions.

. *W. A. Slater, Arthur Hagener, and G. P. Anthes*

A slab 48 by 115.5 feet center to center of outer girders was loaded. The slab is divided into 18 panels, of which 6 are 16 feet square, 6 are 16 by 19.25 feet, and 6 are 16 by 22.5 feet. Measurements of deformations in steel and concrete were measured at about 1,600 places. The moments accounted for by stress in the steel were much less than the moments given by theoretical analysis. There was an increase in stress with continuation of a constant load on the slab, but the load was left in place long enough to indicate that this increase would not lead to a critical condition. (Nov. 15, 1922.) 67 pp. Price, 25 cents.

T221. The Magnetic Susceptibility and Iron Content of
Cast Red Brass.

. *L. H. Marshall and R. L. Sanford*

An investigation was undertaken to determine the practicability of using a magnetic method for the quantitative estimation of small proportions, less than 1 per cent, of iron in cast tin red brass. The magnetic properties and microstructure for seven different samples were determined in the cast condition and as annealed at 800° C. for various periods up to 16 hours. The results showed that the magnetic properties were markedly influenced by heat treatment and were not a simple index to the iron content. (Sept. 22, 1922.) 14 pp. Price, 5 cents.

T222. Relative Usefulness of Gases of Different Heating
Value and Adjustments of Burners for
Changes in Heating Value and Specific Grav-

ity. *Walter M. Berry, I. V. Brumbaugh,
J. H. Eiseman, G. F. Moulton, and G. B. Shawn*

In connection with an investigation conducted by the Public Service Commission of Maryland to determine the most economic heating value standard for manufactured gas in the city of Baltimore, the Bureau of Standards conducted an extensive series of laboratory tests to determine, primarily, (1) the relative utilization efficiency of gases of different heating value, (2) the extent to which present appliances can be adapted to give good and efficient service with gases of different heating value and composition, and (3) what adjustment in appliances is necessary to give the consumers good and efficient service when different kinds of gases are mixed and there is a variation in the composition, heating value, and the specific gravity of the gas. The report discusses these questions in considerable detail. (Oct. 4, 1922.) 77 pp. Price, 25 cents.

T223. Reclamation of Used Petroleum Lubricating Oils

. *Winslow H. Herschel and A. H. Anderson*

The reclamation of used oils is of increasing importance as a means of waste prevention, and the necessary apparatus is already available. The reclaimed oils will pass the usually accepted tests, but further information is needed in regard to the significance of tests for acidity, sulphur, and resistance to oxidation before it can be decided whether additional tests, and perhaps modifications of reclamation methods, are necessary. (Oct. 21, 1922.) 16 pp. Price 5 cents.

- T224. Rate of Exhaustion of a Closed Tank by a Reciprocating Air Pump.....*Edgar Buckingham*

An equation is deduced for finding the number of strokes of a reciprocating air pump required to exhaust a tank of large volume down to any given fraction of atmospheric pressure, assuming that the piston and valves are tight. The resulting formula shows how clearance and valve loading affect the speed of exhaustion and the final minimum attainable pressure. (Jan. 4, 1923.) 8 pp. Price, 5 cents.

- T225. A New Method for Determining the Rate of Sulphation of Storage-Battery Plates.....
.....*G. W. Vinal and L. M. Ritchie*

The object of this investigation is to establish, if possible, a speedy and accurate method for measuring the effect of impurities in storage-battery electrolytes. Preliminary experiments, in which small cells were "poisoned" by the addition of substances to be studied, showed that accurate and consistent results were difficult to obtain. Results given in this paper show that it is possible to determine the rate of sulphation of storage-battery plates accurately by successive weighings of the plates immersed in solutions which are maintained at constant temperature. This paper presents only the fundamental theory of the method and the results of experiments on plates immersed in pure solutions. The extension of the work to include the effect produced by various impurities will be reported in a subsequent paper. (Dec. 19, 1922.) 8 pp. Price, 5 cents.

- T226. A Study of Commercial Dial Micrometers for Measuring the Thickness of Paper.....
.....*Paul L. Houston and D. R. Miller*

In this paper a study is made of the mechanisms, calibrations, areas, and parallelisms of contact surfaces and static contact pressures for different readings of nine commercial micrometers. A performance test is made on the nine instruments, and a new instrument is constructed to measure the compressibility of paper under different contact pressures and different size contacts. The results of the performance and compressibility tests show that different results may be expected from thickness tests on the same paper when different commercial micrometers are used because of their different contact pressures and different size contacts. In the conclusions, recommendations are made for the construction of a new standard micrometer. (Dec. 29, 1922.) 28 pp. Price, 10 cents.

- T227. American and English Ball Clays.....*H. H. Sortwell*

The properties of the 21 American and English ball clays in use in the largest quantities in the manufacture of white-burning ceramic products were studied. The water of plasticity and volume drying shrinkage relations, amount of coarse mineral matter, strength when plastic, behavior in slips, strength in the dry state, amount of carbonaceous matter, volume and porosity relations over a wide range in temperature, and color in a standard body were determined. Comprehensive data on the clays are given, and a classification based on the properties is included. (Jan. 13, 1923.) 30 pp. Price, 10 cents.

T228. Lathe Breakdown Tests of Some Modern High-Speed Tool Steels. . . . *H. J. French and Jerome Strauss*

Modern high-speed tool steels are classified according to chemical composition. The present general tendencies as regards proportions of those elements present which may be classed as impurities are discussed. These data are based on analysis of about 65 lots representing approximately 40 brands produced by various manufacturers during the period 1919-1922. Comparative lathe-cutting tests are reported for about 25 brands representing various type compositions. The test used is known as the "breakdown test" in which the endurance of tools is measured under fixed working conditions, and a discussion of the behavior of the different groups is given under both moderate and severe service. Measurements of power consumed by various steels in severe tests are likewise reported. A discussion is given of some of the limitations of the competitive breakdown test, and recommendations are made regarding its application. (Feb. 17, 1923.) 43 pp. Price, 15 cents.

T229. Some Tests of Steel-Wire Rope on Sheaves.
 *Edward Skillman*

All of the ropes tested were marked "plow steel hoisting rope." They varied from $\frac{5}{8}$ to $\frac{1}{4}$ inch in diameter. One of them had been used for five years, but the others were new. Tests were made to determine the strength of the wires from the ropes, of the straight ropes with socketed ends, and of the ropes when at rest on sheaves of from 10 to 18 inches diameter. The results of the tests are given and the discussion covers the effect of the manner of loading the rope and the effect of overloading on the strength of worn rope. (Mar. 2, 1923.) 17 pp. Price, 10 cents.

T230. A Recording Chronograph for the Inverse Rate
 Method of Thermal Analysis. *H. J. French*

This report describes an apparatus designed for direct plotting of curves for the inverse-rate method of thermal analysis, in which the time interval required for a definite temperature change and the temperature are the coordinates. The fundamentals of its construction and operation are described, and examples of typical curves produced are included. There is also given a brief discussion of the advantages obtained by its use, principally in reducing the time required for determining transformations in metals with equal or greater accuracy than when using ordinary types of chronographs. (Mar. 14, 1923.) 11 pp. Price, 5 cents.

T231. Tentative Standard Test Methods and Percentages
 of Oil and Moisture in Hair Press Cloths. . . .
 *F. R. McGowan and C. W. Schoffstall*

An investigation to set suitable standard percentages of oil and moisture content of hair press cloths. A description of the fabric and its use is given. Methods of procedure for obtaining accurate percentages are outlined and the results of tests on 27 samples are given with graphs illustrating them. (Mar. 10, 1923.) 20 pp. Price, 5 cents.

T232. Shellac.....*Percy H. Walker and Lawrence L. Steele*

A description is given of the source, manufacture, uses, and common methods of testing shellac. Emphasis is laid on the extent to which shellac spirit varnishes are adulterated and the inadequacy of present methods for detecting such adulteration is shown. A new method for detecting adulteration in either flake or spirit shellac is described, and data are given on many samples of different grades. A suggested table for rating shellac samples from the data of this method is given. Recommended methods are given for the determination of such material in shellac as is insoluble in hot alcohol and for the determination of the shellac-alcohol ratio in a spirit varnish. Suggested specifications for pure orange flake shellac and pure orange shellac varnish are given. (Mar. 12, 1923.) 20 pp. Price, 5 cents.

T233. Tests of Heavily Reinforced Concrete Slab Beams:
Effect of Direction of Reinforcement on
Strength and Deformation.....

.....*Willis A. Slater and Fred B. Seely*

Twenty-six slab beams were tested for the purpose of determining the effect of the direction of the reinforcing bars on the stress developed and the relative values of bars and of expanded metal for use as slab reinforcement. An analysis of the mechanics involved indicates greater stresses and deflections for beams with diagonal than for those with direct reinforcement. The test results confirm in a general way the results of this analysis. For the slabs reinforced with expanded metal the distribution of cracks was better than for any of the slabs reinforced with bars. For splicing the expanded metal a lap of about 1.5 diamonds was indicated as being necessary. (Mar. 20, 1923.) 48 pp. Price, 15 cents.

T234. Methods of Measuring the Plasticity of Clays. . . .*F. P. Hall*

Discussion of the term "plasticity" and the methods brought forward for the measurement of plasticity, the factors which each measures, the Bingham plastometer as an instrument for determining relative plasticity of clays, the need for more efficient methods of measuring plasticity. (Mar. 22, 1923.) 22 pp. Price, 10 cents.

T235. Thermal Stresses in Steel Car Wheels.

.....*George K. Burgess and G. Willard Quick*

The paper presents the results of special thermal stress tests made on 33-inch steel car wheels. The wheels were mounted on a hollow water-cooled axle, and the treads were heated to 380° C. by passing an electric current through a soft steel resistor which encircled the wheels. The resulting stresses were calculated from strain-gauge measurements after correcting for thermal expansion. The manner in which thermal stresses build up in wheels, the magnitude, nature, and location of the stresses are given. The wheels withstood the tests satisfactorily, and a few tested to 500° C. showed no sign of failure. The maximum stresses developed were in the extreme fibers and approximated the elastic limit of the steel. (Mar. 24, 1923.) 37 pp. Price, 15 cents.

T236. Loading Test of a Hollow Tile and Reinforced Concrete Floor of Arlington Building, Washington, D. C. . . . *Louis J. Larson and Serge N. Petrenko*

Hollow tile and reinforced concrete panels supported on reinforced concrete beams were loaded, some to 3.8 times the design live load. Maximum stresses were those developed in slab at positions of negative moment. The effect of continued loading was well marked in the first 20 hours and comparatively small later. The beams around the edges of panels offered little resistance to torsion. The cracking of concrete and the resulting great increases of stresses in reinforcing steel showed that concrete carried considerable proportion of tensile stresses. The moment coefficients were generally small, due to low stresses, and are not proposed for design but show the relative amount of bending moments carried in both directions. The factor of safety of the construction is apparently higher than two. (Apr. 21, 1923.) 41 pp. Price, 15 cents.

T237. Aeronautic Instruments. *Franklin L. Hunt*

This paper discusses briefly the types of aircraft instruments which have reached a state of practical development such that they have found extensive use in practice. The instruments described include: *Altitude instruments*, such as altimeters, barographs, statoscopes; *speed instruments*, such as air-speed indicators, ground-speed indicators, rate-of-climb indicators; *orientation instruments*, such as compasses, turn indicators, inclinometers; *engine instruments*, such as tachometers, pressure gauges, gasoline gauges, gasoline flow indicators, thermometers; *navigating instruments*, such as maps, dead-reckoning instruments, astronomical instruments, radio direction finder; and *special instruments* and accessories, such as oxygen instruments, recording instruments, strut and gas temperature thermometers, time pieces, manometers, hydrogen leak detectors. (May 16, 1923.) 65 pp. Price, 20 cents.

T238. Some Compressive Tests of Hollow-Tile Walls. *Herbert L. Whittemore and Bernard D. Hathcock*

Thirty-two tile walls, 4 feet long and 12 feet high, built of exceptionally high strength tile, were tested in compression. The walls fall into groups according to the size of tile, the construction, and the method of loading. The latter was axial for all but six walls for which the load had an eccentricity of 2 inches. About half of the walls were built with the cells vertical and the others with the cells horizontal. Tile from Ohio and from New Jersey were used. Walls with the cells vertical were stronger than where the cells were horizontal. The maximum stress sustained was quite independent of the wall thickness and the total load nearly proportional to this thickness. The walls axially loaded failed under a stress which was about one-third as large as was developed in the single tile. The eccentrically loaded walls developed only about half as great a stress as the centrally loaded specimens. (July 21, 1923.) 15 pp. Price, 5 cents.

T239. Tests of Caustic Magnesia Made from Magnesite
from Several Sources.....

.....*P. H. Bates, Roy N. Young, and Paul Rapp*

Magnesite ores from four different sources, including both the crystalline and amorphous varieties, were calcined under various conditions and prepared for use in oxychloride cement mixtures. Each lot of caustic magnesia was tested in three flooring and two stucco formulas under actual service conditions as well as in the laboratory. The properties of chief interest were time of set, strength, linear change, and water resistance. The various ores used require different conditions of calcination in order to produce caustic magnesiases of a given quality. The properties of the cement mixtures are affected to a very great extent by variations in (1) The degree of calcination of the ore; (2) type of aggregate, and (3) the relative amounts of given constituents in a mixture. (Sept. 14, 1923.) 30 pp. Price, 10 cents.

T240. Dynamometer Tests of Automobile Tires.....

.....*W. L. Holt and P. L. Wormeley*

This paper relates to a continuation of the work described in Technologic Paper No. 213, Power Losses in Automobiles Tire. Dynamometer tests have been made on a large number of tires of different makes, and large differences have been found in their properties. A study has been made to determine the cause of these differences and point out their significance. (Sept. 24, 1923.) 23 pp. Price, 10 cents.

T241. A Comparison of the Deoxidation Effects of Titanium and Silicon on the Properties of Rail

Steel.....*George K. Burgess and G. Willard Quick*

The paper gives the results of a comparison of rail steels finished with additions of ferrotitanium and ferrosilicon in the ladle. The study included the following out of the manufacturing processes of melting, teeming, and rolling of rails; tests on samples from the top and bottom ends of A rails for chemical homogeneity and soundness, various mechanical properties, and a macroscopic and microscopic survey. The results show much less segregation and somewhat greater uniformity in physical properties at the top ends of A rails treated with titanium. At the bottom ends there was practically no evidence of improvement from titanium additions as compared with silicon. Improvements by the additions of titanium seem to be mostly confined to the top portion of the ingot. (Oct. 1, 1923.) 57 pp. Price, 10 cents.

T242. Detector for Water Vapor in Closed Pipes.....

.....*E. R. Weaver and P. G. Ledig*

The electrical resistance of a thin film of a hygroscopic electrolyte is used as an approximate measure of the water vapor in the atmosphere with which the film is in contact. The detector is a very simple device easily adapted for use in high-pressure piping and other situations in which the determination of water vapor is usually attended with difficulty. Laboratory experiments showing the reliability, method of application, and limitations of the device are described. (Oct. 1, 1923.) 8 pp. Price, 5 cents.

T243. Stresses in a Few Welded and Riveted Tanks

Tested Under Hydrostatic Pressure.....

.....*A. H. Stang and T. W. Greene*

For the purpose of ascertaining the relative merits of riveted, as compared with electric-welded tanks, four steel tanks, 4 feet in diameter and 10 feet long, were tested under hydrostatic pressure. The ends of the tanks were spherical, having a radius of 4 feet. Strain-gauge measurements were made at different pressures and the stress distribution and the stress-pressure relationship obtained. The results of the hydrostatic tests proved rather unsatisfactory for comparing the relative strengths of the different types because of secondary failures. Secondary stresses, which produced failure in each case, were caused by (a) faulty design of the attachment of the spherical end to the cylindrical shell, (b) nonconformity of the shell to an accurate circular section, and (c) discontinuities in the shell for the manhole and fittings. (Oct. 13, 1923.) 24 pp. Price, 10 cents.

CIRCULARS.

C120. Construction and Operation of a Simple Home-Made Radio Receiving Outfit.

The construction of a very simple radio receiving equipment for radio communication on wave lengths between 600 and 200 m from high-power stations within 50 miles is described. This set may be easily constructed by anyone from materials which can be readily secured. The total cost of this equipment need not exceed \$10. A single circuit, with a crystal detector and an inductor variable by steps, is used. Instructions are given for the construction of the crystal detector, inductor, necessary switches, antenna, and other parts. Certain parts, such as the telephone receivers, must be purchased. Directions for operation are also given.

C121. Construction and Operation of a Two-Circuit Radio Receiving Equipment with Crystal Detector.

The construction of a very simple radio receiving equipment is described which may be easily constructed by anyone from materials which are readily obtainable. The total cost of the equipment need not exceed \$15. A double circuit, composed of primary and secondary inductors, which are variable by steps, and a crystal detector are used. Instructions are given for the construction of the inductors, switches, wood parts, and crystal detector. Reference is made to Bureau of Standards Circular No. 120, which describes the construction of the other necessary parts. Certain parts, such as the telephone receivers, must be purchased. Directions for operation are also given.

C122. Sources of Elementary Radio Information.

The recent developments in radio communication have been so rapid that much important radio information has not yet been collected in books but must be sought in periodicals and other sources. A number of important books have appeared recently and are not generally known. The Bureau of Standards is constantly receiving requests for radio information. Many of the inquires call for the same information, and in order to facilitate the handling of such inquires this circular has been prepared. This circular gives information concerning radio periodicals, radio books issued by various publishers, Government radio publications issued by various bureaus, including the publications of the Bureau of Standards, radio laws and regulations, and call letters, and answers a few of the most usual elementary questions concerning radio communication which are asked by the novice.

C123. United States Government Specification for White Floating Soap.

The material covered by this specification is a high-grade cake soap suitable for toilet use and for fine laundry work.

NOTE.—This specification is one of a series of specifications prepared to cover 10 different kinds of soap, each suitable for a particular purpose. The specifications were prepared under the auspices of the Bureau of Standards by a technical committee of the Federal Specifications Board in cooperation with the soap committee of the soap section of the American Specialty Manufacturers Association. The specifications, in general, cover the maximum and the minimum of the ingredients; also methods of sampling and laboratory examination, preparation of reagents, and basis of purchase.

C124. United States Government Specification for Liquid Soap.

The material covered by this specification is a clear solution of pure vegetable oil potash (or potash and soda) soap for toilet use in dispensing-machines. (See also note in abstract for C123 for further data.)

C125. United States Government Specification for Soap Powder.

The material covered by this specification is a uniform mixture of soap and sodium carbonate in powdered form. It is suitable for general household work owing to its ease of application, solubility, and cleansing quality. (See also note in abstract for C123 for further data.)

C126. United States Government Specification for Salt Water Soap.

The material covered by this specification is a coconut-oil soap suitable for use in both sea water and fresh water. (See also note in abstract for C123 for further data.)

C127. United States Government Specification for Automobile Soap.

The material covered by this specification is a pure vegetable-oil paste soap containing no free alkali or acid and suitable for use in washing automobiles. (See also note in abstract for C123 for further data.)

C128. United States Government Specification for Chip Soap.

The material covered by this specification is a high-grade soap in chip form, free from rosin and impurities. It is suitable for high-grade laundry work with soft water. (See also note in abstract for C123 for further data.)

C129. United States Government Specification for Ordinary Laundry Soap.

The material covered by this specification is a well-made, uniformly mixed laundry or common soap. It is suitable for use with moderately hard water for general cleaning and laundry purposes. (See also note in abstract for C123 for further data.)

C130. United States Government Specification for Grit
Cake Soap.

The material covered by this specification is a compact cake soap containing finely divided siliceous material. Two grades are specified: (a) For fine work, such as glass and enamel; (b) for scouring and scrubbing. (See also note in abstract for C123 for further data.)

C131. United States Government Specification for Scouring
Compounds (a) and (b) for Floors, and
Soap Scouring Compound (c).

This specification covers three grades of powdered material composed of siliceous matter, sodium carbonate, and soap: (a) For fine marble floors, (b) for tile or ceramic and terrazzo floors, and (c) soap-scouring compound for general cleaning and scrubbing. (See also note in abstract for C123 for further data.)

C132. United States Government Specification for Hand
Grit Soap.

The material covered by this specification is a high-grade cake soap containing about one-third its weight of clean, finely divided, insoluble siliceous matter. (See also note in abstract for C123 for further data.)

C133. Description and Operation of an Electron-Tube
Detector Unit for Simple Radio Receiving
Outfits.

The apparatus now used (1922) for radio reception, except the most simple types, uses electron tubes. The tube may be used as a simple detector, or may be used in more complicated circuits employing various kinds of amplification, or regeneration, beat reception, or other methods. A set employing an electron-tube detector is more sensitive than a set employing a crystal detector and may be expected to give more satisfactory results. This circular describes a simple electron-tube detector receiving set and gives a method of operating it. An antenna, lightning switch, ground connection, and telephone receivers, which can be used with this set, are described in Circular 120. Tuning devices for use with this electron-tube detector unit have been described in Circulars 120 and 121. A number of the parts of the detector unit should be purchased. A complete description of the method of assembling and wiring the detector unit is given. Illustrations are given showing the arrangement of the various parts and the complete assembled detector unit. Detailed instructions for operating the set are also given.

C134. United States Government Specification for Fire-
Extinguishing Liquid (Carbon Tetrachloride
Base).

This specification was prepared by a technical committee of the Federal Specifications Board. Before final approval it was submitted to the Underwriters' Laboratories and to a large number of manufacturers of such products, whose suggestions were carefully considered. The specification covers the general conditions, appearance, specific gravity, cold test, distillation test, impurities, sampling, and methods of testing.

C135. Caustic Magnesia Cement.

A brief summary of the discovery, early history, and later application of the reaction of caustic magnesia with solutions of magnesium chloride. The result of this reaction produces a quick hardening cement used in the stucco, flooring, and ship-decking trade. Short descriptions are given of the ore used, methods of calcining the ore, also suggested formulas for several types of products, the general qualities of these, and the lines along which specifications for the cement are being developed.

C136. Specification for Numbered Cotton Duck for Government and Commercial Use.

Specifications are given including weave, width, weight, count, ply, and breaking strength, also an expression as to what constitutes a good delivery. These specifications were drawn up by the Cotton Duck Association and the Bureau of Standards after extensive research, valuable assistance being given by other Government departments.

C137. Auxiliary Condensers and Loading Coil Used With Simple Homemade Radio Receiving Outfits.

This is the fourth circular in a series of descriptions of very simple radio receiving outfits which will receive radio telephone signals and also radio telegraph signals, except those transmitted by the use of uninterrupted continuous waves. In Circular No. 120 a single-circuit receiving set was described, and in Circular No. 121 a two-circuit set was described. The operation of either can be improved by the use of a very simple and cheap condenser connected across the telephone receivers and a similar one connected in series with the antenna. Longer waves can be received by the use of a very simple type of loading coil. The coil is particularly useful in connection with the single-circuit receiving set.

C138. A Decimal Classification of Radio Subjects—An Extension of the Dewey System.

This circular gives a decimal classification of radio subjects which was developed at the Bureau of Standards about two years ago. This classification is suggested as an extension of the Dewey decimal system and has been found to be very useful in classifying radio references, drawings, books, and reports. Radio communication is divided into a general class and a number of specific classes, each with appropriate subdivisions. An abbreviated classification is suggested for those readers who have only a small amount of material to classify. This may then be gradually extended as the needs of the user dictate. An index is also provided.

C139. United States Government Specification for Dry Cells.

This specification is a revision of that originally published in the first edition of Circular No. 79. Much additional experience has been gained in testing dry cells since the specification was first issued, and a revision was deemed desirable. The Bureau of Standards called a conference of representatives of manufacturers, Government departments, and a few of the largest individual users of dry cells and flashlight batteries, to consider the standardization of sizes and a revision of specifications for them. This conference met at the bureau on December 5 and 6, 1921. A limited number of the most important sizes were standardized and tests defined. The bureau was asked to complete the revision of the specification and to submit it to the members of the conference for criticism. This has been done. This specification includes the dimensions as agreed upon.

C140. United States Government Specification for Wood Screws.

This specification covers flat, round, and oval head types, together with the numbers, diameters, threads per inch, methods of measuring diameters and lengths, tolerances, and the standard sizes of brass and steel wood screws. The requirements of this specification are standard, and were drawn with the assistance and approval of the manufacturers.

C141. Description and Operation of an Audio-Frequency Amplifier Unit for Simple Radio Receiving Outfits.

This is the fifth circular in a series of descriptions of very simple radio receiving outfits. In Circular No. 133 an electron-tube detector unit to be used in conjunction with the single-circuit set (Circular No. 120) or with the two-circuit set (Circular No. 121) is described. This circular describes an audio-frequency amplifier unit, one or two of which may be used with the apparatus just mentioned, to increase the receiving radius of the station, as well as the volume of sound in the telephone receivers.

C142. Tables of Thermodynamic Properties of Ammonia.

These tables of the thermodynamic properties of saturated and superheated ammonia are based on measurements made at the Bureau of Standards. The tables have been put in convenient form for use in engineering practice, and the same data are given in graphic form as a Mollier chart. The range of temperature and pressure covered by the tables is greater than that usually encountered in the use of ammonia as a refrigerating medium.

C143. Recommended Specification for Quicklime for Use in Causticizing.

A brief description of the way in which lime is used in causticizing is followed by a general statement as to the quality of lime required. The standard of quality for lime for this purpose is set at 85 per cent available lime. Any shipment containing less than 70 per cent available lime or more than 3 per cent magnesia should be rejected as uneconomical to use. Complete directions for sampling, testing, and retesting are included.

C144. Recommended Specification for Limestone and Quicklime for Use in the Manufacture of Sulphite Pulp.

Limestone or quicklime is used to prepare the cooking liquor in which wood is cooked to reduce it to paper pulp. It is customary to use a high calcium limestone when preparing liquor by the tower process, or a high magnesian quicklime with the tank process, but other kinds of limestone or quicklime are being used. The specification, therefore, covers high calcium and high magnesian limestone and quicklime, on a basis of about 95 per cent purity.

C145. Summary of Technical Methods for the Utilization of Molasses, Collated from Patent Literature, for the Use of the American Sugar Industry.

Economic conditions the world over have made it generally recognized that the future of the American beet-sugar industry is to a great extent dependent on the profitable utilization of the molasses produced. The latter contains numerous valuable substances which have never been successfully recovered outside of Germany. For many years that country has seen fit to veil its developments and discoveries and to maintain the strictest secrecy regarding the operation of its molasses plants. The scientific literature on the subject is practically barren, so far as the actual results achieved in Germany are concerned. In order to carry out the necessary experimental work for the American industry, every possible source of information has been investigated. After a few clues were obtained, the U. S. Patent Office literature was searched and eventually over 1,000 German patents on molasses utilization and associated subjects were uncovered. The difficulty in locating these patents was due to the fact that they are not listed under sugar or molasses or subjects that were known to the bureau's investigators. The value of the information contained in many of these patents was so apparent and the necessity for knowledge of their contents was so obvious that the present résumé of the more important patents on the recovery of the nonsugars has been compiled.

C146. United States Government Specification for Water Resisting Red Enamel.

This specification was prepared by the technical committee on paints of the Federal Specifications Board after careful consideration of suggestions from manufacturers. The specification calls for an extremely durable, highest quality, red enamel, suitable primarily for outside use. Details as to general requirements, methods of sampling, and testing are included.

C147. United States Government Specification for Gloss Interior Lithopone Paint. White and Light Tints.

This specification was prepared by the technical committee on paints of the Federal Specifications Board, after carefully considering suggestions from paint manufacturers. This specification relates to paints not intended for outside exposure. They shall dry to gloss opaque coats that will adhere well to wood, metal, and plaster; stand washing with soap and water; and show no yellowing when kept in the dark. Detailed directions for sampling and testing are included.

C148. United States Government Specification for Leather Belting.

United States Government specifications for leather belting developed by the Bureau of Standards, subcommittee on leather products of the Federal Specifications Board, and a committee representing the manufacturers. Standard specification relative to the quality of the leather and construction of the belting is included. Physical and chemical requirements are provided, which serve as standards of quality, together with methods for making the tests.

SIMPLIFIED PRACTICE RECOMMENDATIONS.

R1. Elimination of Waste—Simplified Practice Recommendation No. 1.—Paving Bricks.

Specific example of the application of the principle of simplification to the paving brick industry. Describes the need for eliminating economic waste caused by the excessive variety in types and sizes of paving bricks and shows the procedure used in reducing existing varieties from 66 to 7.

The industry initiated the action through its trade association, and the Government, through the Department of Commerce, indorses and publishes as its own those simplifications recommended by joint conferences of producers, distributors, and users of the commodity.

These simplified practice recommendations when accepted by the entire industry serve as commercial standards of practice with consequent benefit through decreased stocks, costs, and investments, and increased sales, turnover, and income.

In order to further simplify the production of paving brick, the conference of 1923 eliminated an additional type of brick, reducing the 7 recognized types and sizes to 6. This procedure was based upon a resurvey by the Paving Brick Association, which showed that 80 per cent of the entire production during 1922 was within the 6 varieties.

R2. Elimination of Waste—Simplified Practice Recommendation No. 2—Bedsteads, Springs, and Mattresses.

Since the inception of the division of simplified practice, conferences of representatives of manufacturers, distributors, and users are held to determine and eliminate excess varieties and types of products with a view to simplifying their lines in the production of commodities. On May 15, 1922, representatives of the bed, spring, and mattress industry convened at the department in cooperation with the division of simplified practice, and adopted four standard widths of beds of one standard length, springs and mattresses to conform therewith. These recognized sizes and types will be considered as standards, subject to annual revision by a similar conference.

MISCELLANEOUS PUBLICATIONS.

M49. Graphic Comparison of Screw Thread Pitches.

A graphic chart is given showing the number of threads per inch and pitch in millimeters for both inch and millimeter systems. A simple method permits finding the nearest equivalent of one system in terms of the other. A table is printed with the chart from which values may be given more closely than can be shown in the chart and for those who prefer to use a tabulated statement. 1 p. Price, 5 cents.

M50. Annual Report of the Director of the Bureau of Standards to the Secretary of Commerce for the Fiscal Year Ended June 30, 1922.

In addition to the statement contained under M34, it should be stated that the present report emphasizes particularly the relation of the Bureau of Standards to the industries of the country. During the fiscal year covered by this report particular effort was made to solve such industrial problems as the elimination of unnecessary waste, the simplification of sizes, and the application of the results of research work to the practical problems of manufacturing. The work of two new divisions is described for the first time in this report; that is, the division of building and housing and the division of simplified practice. 298 pp.

M51. Fifteenth Annual Conference on the Weights and Measures of the United States.

Contains: addresses by the Secretary of Commerce; the chairman, Committee on Coinage, Weights, and Measures, House of Representatives; and the president of the conference; papers and discussions on subjects such as method of test of gasoline-measuring, linear-measuring, and leather-measuring devices, a uniform ton for coal, standard weight bread, the elimination of dry measures from commercial use, protection of highways by means of portable weighing devices, equipment for testing heavy-capacity scales, wholesale deliveries of gasoline especially by vehicle tanks, Federal and State approval of type of apparatus, relationship between officials and merchants and manufacturers, and manufacture of precision standards. Reports were made on the accuracy of and tolerances for heavy-duty automatic scales, and tolerances for bread and for linear-measuring devices, the latter being tentatively adopted. 148 pp. Price, 15 cents.

M52. Mollier Chart of Properties of Ammonia.

This chart presents, in graphic form, a complete table of the thermodynamic properties of ammonia, over the range of temperature and pressure useful in refrigerating engineering. It provides a rapid and convenient means for the solution of practical problems, and its accuracy is ample for this purpose. The chart itself is about 9 inches high by 23 inches wide. 1 p. Price, 5 cents.

M53. Annual Report of the Director of the Bureau of Standards to the Secretary of Commerce for the Fiscal Year Ended June 30, 1923.

The arrangement of this report differs from previous annual reports. The first portion deals with the functions and organization of the bureau and its relations to the Government, to the industries, and to the public. Some of the more important lines of work carried out during the year are briefly mentioned.

Detailed reports of the work of the various divisions are given as heretofore, the names of those in charge of organization units and investigations being added. At the beginning of each division's report there is given a summary of the functions, expenditures, staff, publications issued, etc. These summaries are immediately followed by a work chart giving the status of all tests and researches on June 30, 1923.

During the year 100 conferences were held between the bureau and representatives of American industries; 19 research associates were maintained in the bureau by industrial associations and manufacturers; approximately 127,000 tests were made; and 91 new publications were issued. The funds received during the year (including funds transferred from other departments) totaled \$1,719,156.92. The bureau staff comprised 896 employees.

On December 31, 1922, Dr. S. W. Stratton, director of the Bureau of Standards since its establishment in 1901, resigned. Dr. George K. Burgess, formerly chief of the metallurgical division, was appointed as his successor.

Special publication: Recommended Minimum Requirements for Small Dwelling Construction.

The report describes circumstances leading to appointment of Department of Commerce Building Code Committee; preliminary investigational work carried on by committee; details of measures for obtaining information on special questions; and cooperation extended by various interested organizations. It presents complete requirements for construction of small dwellings, in form suitable for adoption by States and cities. The requirements include sections on masonry walls of all types used in such structures; frame dwellings, with and without veneer of brick, stone, or stucco; wood framing in masonry structures; floor and roof loads; plastering; fire-stopping; and chimney construction.

A voluminous appendix is added to the report which explains reasons for many of the provisions recommended and gives much practical information on building materials and methods and also includes numerous illustrations of approved building practice. (July 20, 1922.) 108 pp. Price, 15 cents.

9. SUBJECT INDEX TO NEW PUBLICATIONS.

The consolidated index in Circular 24 is designed to include citations to titles, cross references, and subsidiary topics of all printed publications of the bureau listed in that circular. The following index supplements the index in Circular 24 by giving the additional index references to cover new publications announced in this supplement. The circular and supplement and the two indexes contained therein cover all bureau publications up to the date the supplement goes to print.

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